The Refrigeration Service Engineer

Vol. 6
No. 8

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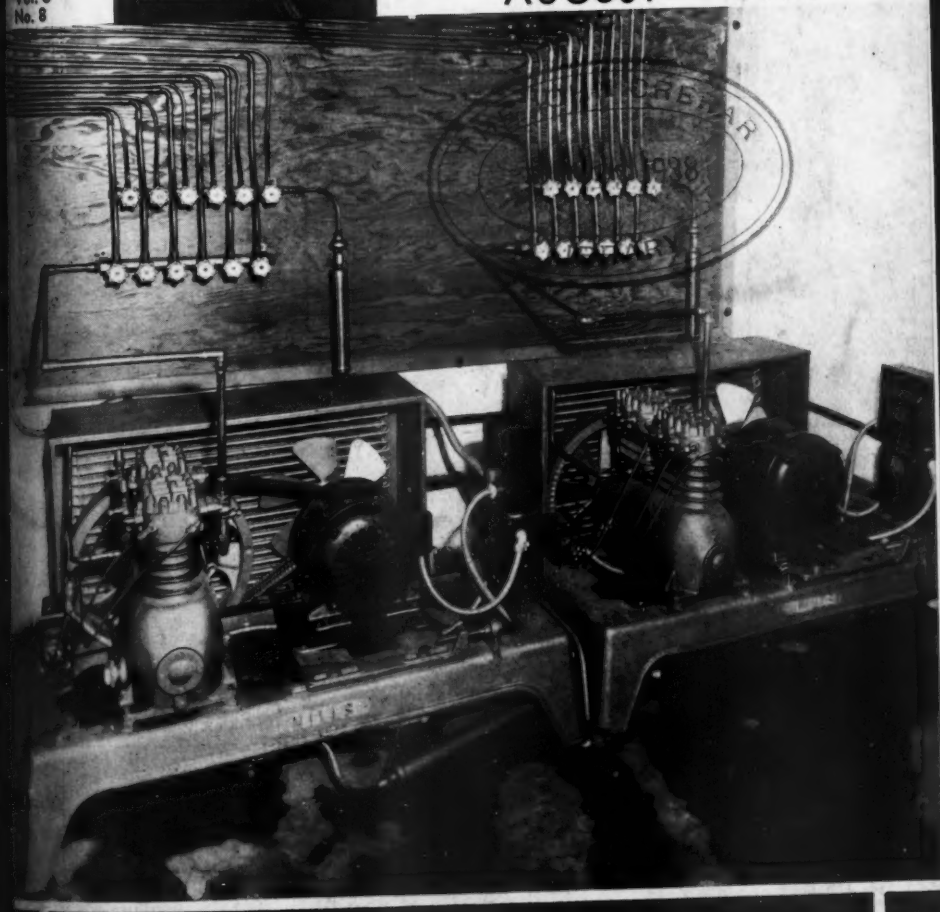

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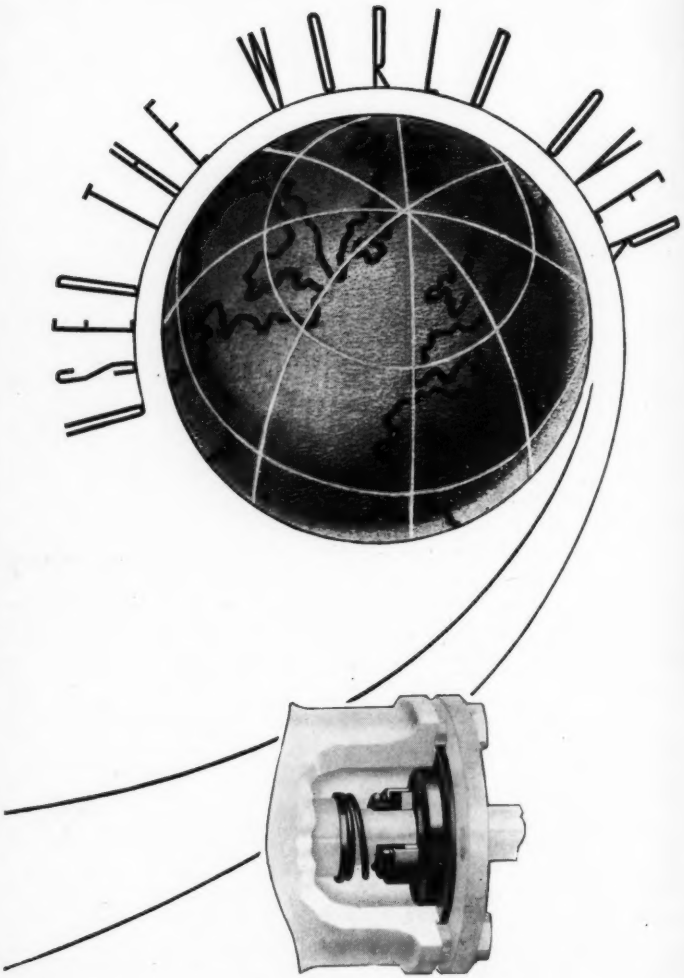

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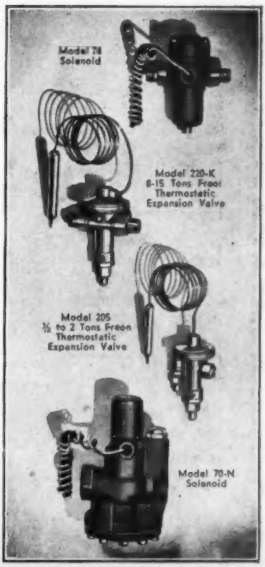

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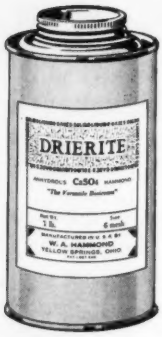

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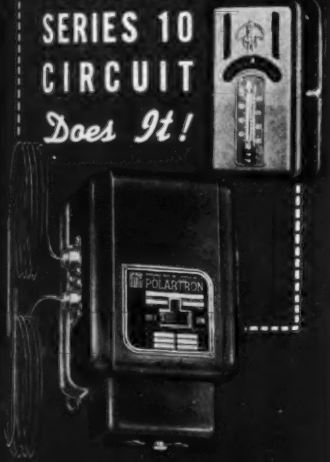

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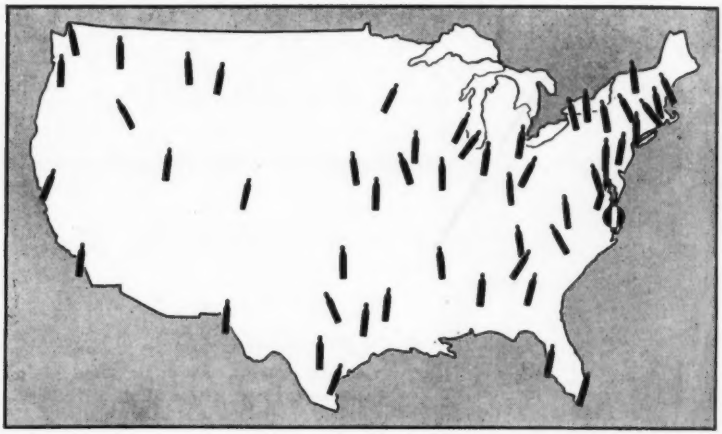

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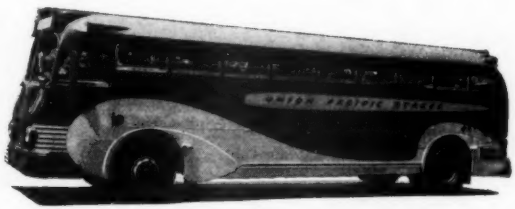

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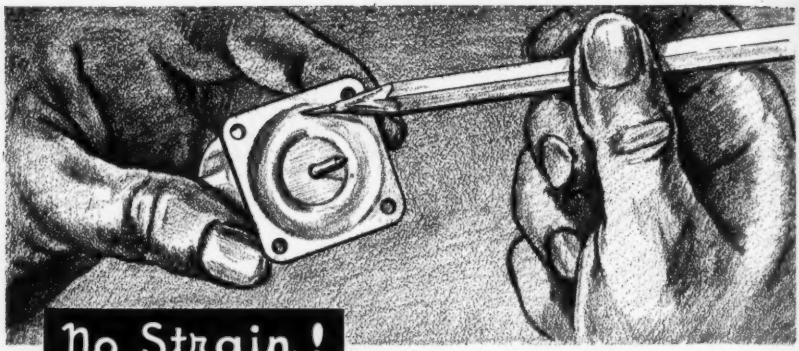

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No Leakage!

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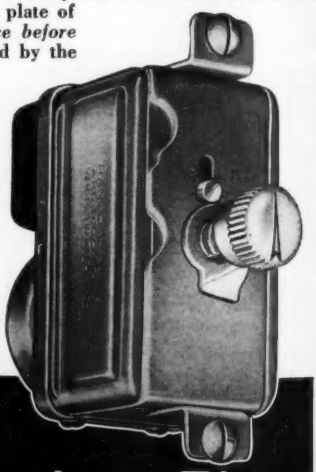

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The Refrigeration Service Engineer

Vol. 6 No. 8

August, 1938

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

Cover

This month's cover is a view of Mills condensing units, installed in an ice cream dispensing establishment. On page 56 will be found a complete description of the installation.

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DETROIT SOLENOIDS

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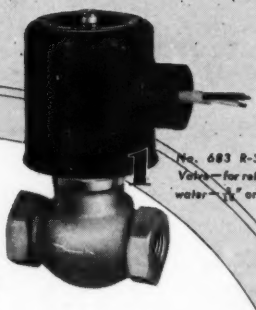

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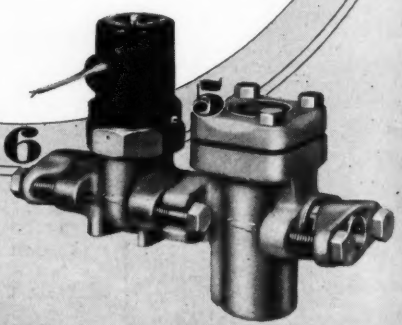

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The Refrigeration Service Engineer

VOL. 6, NO. 8 CHICAGO, AUGUST, 1938 $2.00 per Annum

Baking With Retarded Doughs

The Application of Refrigeration in the Baking Industry

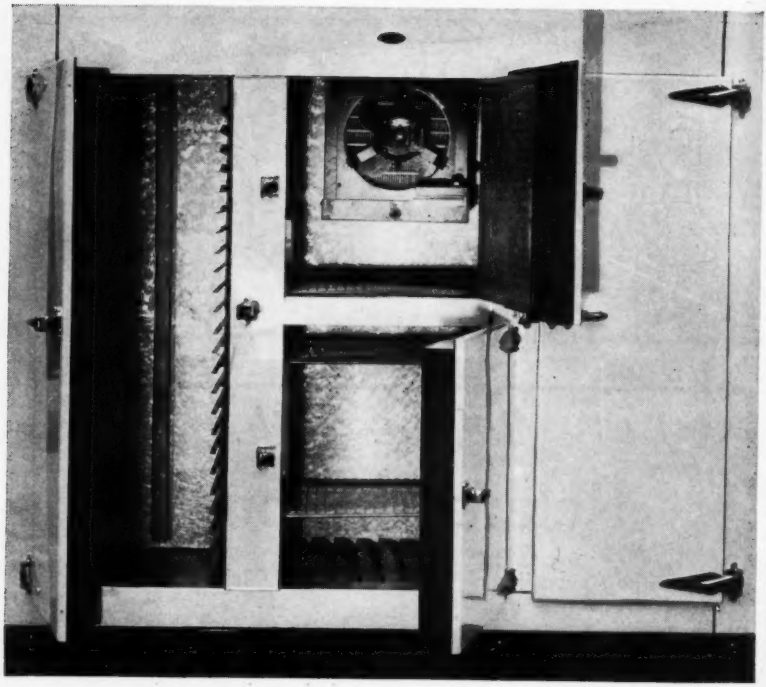
By F. P. SIEBEL, JR., B.Sc., Ch.E.*

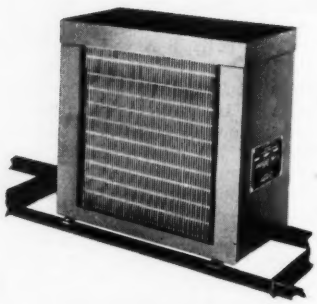
ALTHOUGH baking with retarded or refrigerated doughs is a rather recent innovation in the baking industry of this country, its history merely covering the span of a decade, the various advantages that are offered by this process have been recognized by a large number of progressive retail bakers. It is true that there is still a formidable group of bakers who are as yet rather skeptical about the actual advantages of this process. Others, with some rather unfortunate results obtained during the first stages of its introduction still in their minds, may even be definitely opposed to it. However, it may be safely assumed that with progressing development and research work some of the difficulties still encountered will be overcome and that within a comparatively brief period of time baking with retarded doughs will be the rule rather than the exception.

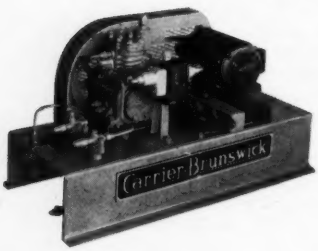
In discussing any relatively new process it is essential to dwell upon its underlying principle in order to assure a correct and thorough understanding of its operation. It is equally essential to also point out its advantages and possible disadvantages. Only by such a procedure will a basic understanding be reached which, in the final analysis, will be the deciding factor in the acceptance, or perhaps rejection, of the process.

The statement that fermentation is a manifestation of life may appear somewhat trite to many bakers. It is, however, important to keep this fact well in mind when discussing the mechanism of retarding doughs. The yeast cell is a living entity that consumes food, grows and reproduces. In short, it behaves like any other living single cell organism. Fermentation by living yeast is generally accepted to be a process by which yeast obtains energy for growth and metabolic activities. Many workers consider both processes, namely yeast growth and fermentation, as synonymous. The rate of fermentation is governed by a great number of factors, such as concentration of yeast, amount of fermentable sugars present, the fermentative power of the yeast, temperature, pH of the medium, and others, and may be measured by the disappearance of certain nutritive substances; namely sugars, or by the appearance of fermentation products, such as alcohol or

* Secy.-Treas., Utilities Engineering Institute, Chicago, Ill. Reprinted with permission from The Bakers Technical Digest.



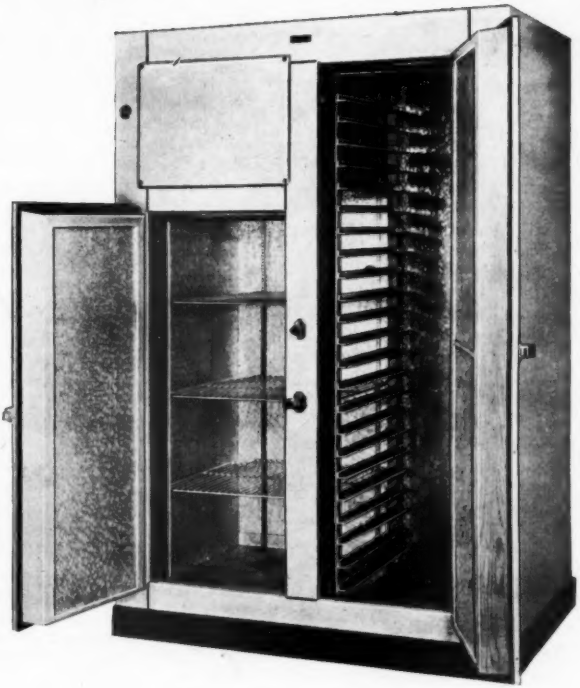


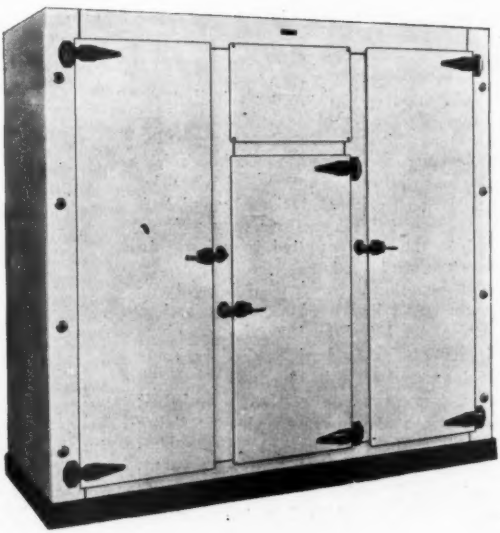


THE CARRIER REFRIGERATOR, COLD DIFFUSER AND ½ HP. COMPRESSOR.—The temperatures maintained are approximately 38 degrees plus or minus a maximum variation of 2 degrees. This is accomplished simply by using a sensitive type room thermostat located inside the Refrigerator to automatically start and stop the refrigerating machine. Relative humidity is maintained by properly designing the air conditioning unit with sufficient surface taking into account a correct temperature differential between the refrigerator temperature and the evaporating refrigerant temperature. Air distribution is critical in this application due to case hardening and a minimum quantity of air must be circulated yet there must be a sufficient turn-over to maintain even temperature and humidity conditions in all corners of the refrigerator. Sanitation is obviously necessary and the simple construction of the shelving and easy accessibility of the working parts of the air conditioning unit make the problem of air purity simple and easy to maintain.

P. J. ORBESEN RETARDED DOUGH CABINETS

The manufacturers of the retarding cabinets shown on this page emphasize in particular the economical operation of this equipment. Heavy duty 3-inch corkboard insulation affords perfect protection against high temperatures. The ⅛-inch galvanized angle iron pan supports are spaced 3 inches apart and thus give ample storage space for pans. There are 23 pan racks in the smaller two-door cabinet and 46 in the larger three-door cabinet. Each has three wire shelves for the storing of other bakery perishables. The conditioned air coil gives reliable humidity and temperature control. The BTU heat load in the smaller cabinet is 1500 BTU's per hour, while in the larger cabinet it is 2000 BTU's per hour. The exterior is made of gleaming white enamel or, if preferred, of white oak. The cabinets are sectionally constructed and are set up although, if desired, they may be taken apart.





carbon dioxide gas. In the case of dough fermentation, the main product is carbon dioxide gas and the rise of the fermenting dough is a measure of the rate of fermentation. Yeast, however, is not the only substance active in fermentation. There are numerous enzymes which bring about a disintegration of the flour substances and give rise to acids, esters, etc. These products are chemical substances of various composition and are of vital importance to the subsequent flavor value of the finished products coming from the oven.

It is thus readily apparent that the process of fermentation is not a simple production of carbon dioxide at the expense of fermentable sugars, but rather a very complex phenomenon involving a great variety of individual reactions and subject to a great many outside influences.

Fermentation, under normal conditions, will proceed until all of the fermentable sugars are used up. It is, however, undesirable to let fermentation reach its natural termination since the resulting dough will lose a great many of its desirable qualities and characteristics and will show distinct signs of deterioration. It is, of course, impractical to stop fermentation by the withdrawal of one or more of the essential factors from the system directly. On the other hand, the extent of fermentation may be quite easily controlled by regulating outside conditions, such as raising the temperature, as is done in baking, or by decreasing the temperature, as is done in the retarded dough process.

Importance of Temperature

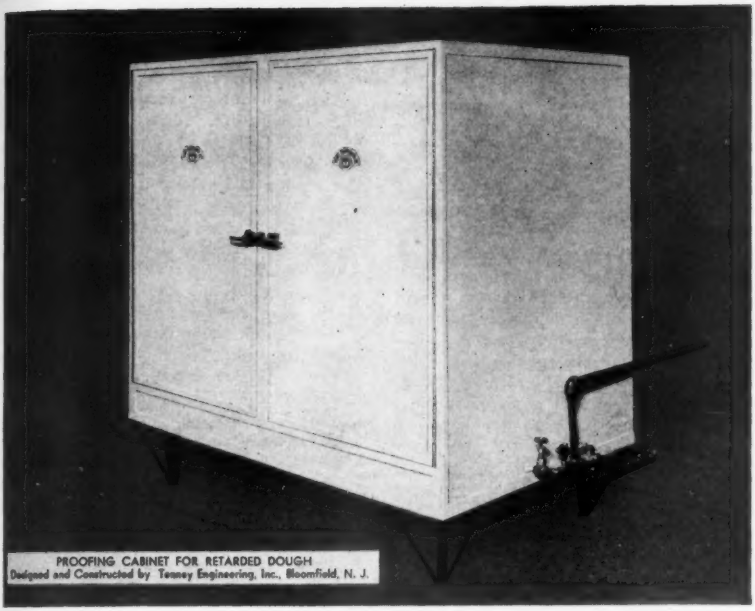
It is a generally known fact that in almost all chemical and biological reactions temperature plays an exceedingly important role. Any number of well established industries come to mind whose very existence depends on the proper control and regulation of temperature. Temperature may well be likened to the reins applied to a horse to control its speed. It is the regulator of the speed of reactions. Increased temperatures generally entail increased rates of reaction, while decreased temperatures have an opposite effect. This basic principle finds a striking application in the retarded dough process. Since yeast is a living organism it complies with the laws applying to living organisms. High temperatures, other conditions being conducive, bring about an increased growth and rate of metabolism in living organisms, while low temperatures tend to retard both growth and metabolism. The profuse growth of vegetation in tropical zones as compared with the scant growth of vegetation in colder regions may serve as an illustration. Thus when a fermenting system is cooled rapidly, there will be a steady and correspondingly rapid decline in the rate of fermentation until at temperatures approaching the freezing point fermentation will, in most instances, cease entirely. There are, however, certain types of yeast which retain their fermentive powers even below freezing temperatures.

Rate of Cooling

One of the main problems encountered in retarded dough processing is the rapidity with which fermentation can be terminated once the dough has been placed in the refrigerator. Experiments described in one of the trade journals indicate rather definitely that considerable time elapses between the time the dough is placed in the refrigerator and the time when it has cooled down sufficiently to practically stop fermentation. The average temperatures prevailing in retarded dough boxes, which are specially constructed refrigerators, range from 33 to 38° F. Any measurement of the time period necessary for a piece of dough to chill to this temperature must, of course, take cognizance of the size of the dough piece thus stored. It need not be mentioned that smaller units will chill considerably quicker than larger units.

This same problem does not exist to quite the same extent with unfermented doughs, since the reactions occurring there are not quite so active. It is, therefore, quite a simple matter to obtain good results with rolled-in doughs and particularly with doughs prepared for rolls, biscuits and the average varieties of cookies, while bread doughs are more difficult to handle.

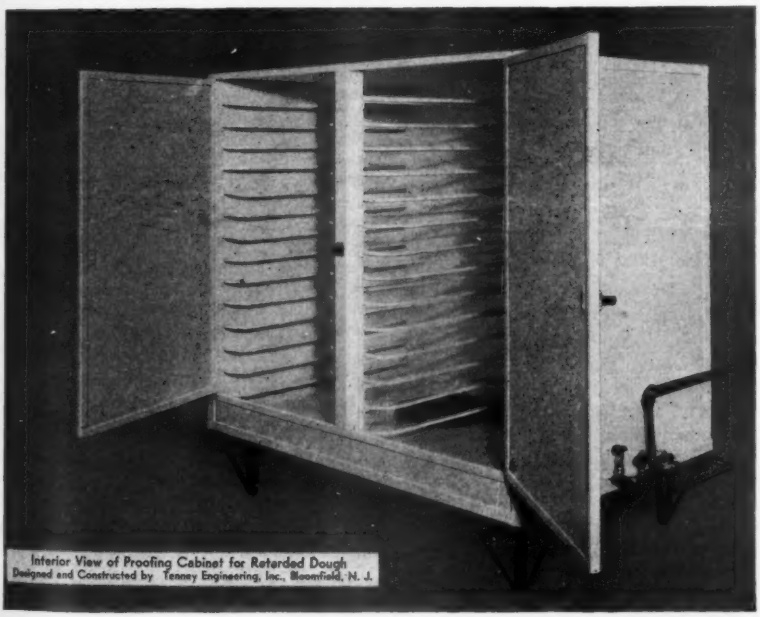
Contrary to what might be expected, the richness or leanness of the dough is of little significance to the rate of cooling. Equal quantities of different doughs will cool at approximately the same rate. That not all activity ceases in chilled dough may be surmised from the somewhat lower pH value of the finished baked product as compared with the product obtained from normal dough, which seems to indicate that acid formation continues, even though at a greatly reduced rate. There is, however, no indication that this acidification has any adverse effect on the general quality and flavor of the baked product since it remains within limits undetectable by the human taste sense.



PROOFING CABINET FOR RETARDED DOUGH
Designed and Constructed by Tenney Engineering, Inc., Bloomfield, N. J.

THE TENNEY RETARDED DOUGH CABINETS

The air in these cabinets is circulated by means of a caseless fan not shown in the cut. The air is forced up around the sides, front and back walls of the box, being drawn down through the center. This forms uniform air distribution throughout the cabinet without drafts. The air is cooled by a small self-contained 1 HP. air cooled compressor and is humidified by a spray which is emitted into the distributed air from below from a copper tank. The cabinets are designed to hold fifty-six pans and the shelves are adjustable to permit setting some shelves for high goods and others for low goods. The refrigerating cabinet is maintained at 36 degrees F. and 90 per cent relative humidity.



Interior View of Proofing Cabinet for Retarded Dough
Designed and Constructed by Tenney Engineering, Inc., Bloomfield, N. J.

The Moisture Problem

Another problem encountered in refrigerated dough processing is the loss of moisture from the dough, which is evidenced by cracks appearing on its surface. Warm air has a greater capacity for retaining moisture than has cool air. Since the air in a refrigerator is comparatively cool, its moisture retaining capacity is correspondingly low. The tendency exists, therefore, to reach an equilibrium between the very moist dough and the relatively dry air with a resultant loss of moisture in the dough. This problem has been far-reachingly solved in the more modern retarded dough boxes in which the cool air is kept nearly saturated with moisture, thus preventing it from absorbing additional moisture from the dough pieces.

It is, of course, essential that the temperature prevailing in a retarded dough box is maintained uniformly and that excessive fluctuations are avoided as much as possible. This requirement has been greatly instrumental in influencing the recent trend of subdividing the boxes into a number of separate units or compartments, whereas formerly the "walk-in" type prevailed. With this latter type of box each time the door was opened the warm outside air entered the entire box. This resulted in a general increase in temperature of the entire atmosphere within the box. It can readily be realized that such fluctuating temperatures had a rather unfavorable effect on the quality of the doughs, since the active constituents of the dough never really reached the dormant stage of cooling. It is this condition, unrecognized by many bakers who pioneered in the application of the retarded dough process, that caused many of them to discard their equipment and abandon this process. The majority of the more recently constructed boxes are of the compartment type which eliminates many of the former objections.

Construction of Boxes

It is needless to state that the boxes should be so constructed that they meet all the requirements placed on them by the baker. This means that they should have sufficient refrigeration capacity and also ability to maintain the temperatures aimed at. These factors must be determined at peak loads and due consideration must also be given to the heat leaks existing under actual working conditions. Particular attention must be paid to the insulating efficiency of both the walls and the doors. Since the general environment of the retarded dough box usually has a relatively high temperature, proper insulating capacity of the refrigerator is of primary importance if undue loads on the refrigeration units of the box are to be avoided. Superior insulating material may represent a higher initial cost, but will more than compensate for this expenditure over a longer period. Also, doors should be closely inspected for possible heat leaks along the surfaces of contact with the box proper.

Since the installation of a retarded dough box represents a formidable item of expenditure to the average retail baker, he may rightfully ask, "What are really the advantages?"

These may be summarized briefly as follows: Stale goods are eliminated almost completely since the baker can now more nearly gauge his production to actual demands and need no longer rely entirely on the rather uncertain element of anticipation. He can offer his customers a considerably increased selection of variety of goods, being able to make up the doughs in advance and store them under retarding conditions while preparing new batches. Such a procedure necessarily permits a greater flexibility in the production schedule and preparations can be made beforehand for anticipated peak demands without running the risk of waste or spoilage. Another important advantage is that by properly utilizing the possibilities offered by the retarded dough box much of the objectionable night work can be totally eliminated. It is needless to point out the favorable effect such a step would have on the personnel in general. Of greatest appeal to the retail baker is probably the fact that baked goods can be sold fresh and even warm from the oven at almost any time of the day. This fact alone can be used very effectively in any sales appeal that the baker may wish to make to the public. Finally, it may be pointed out that as far as present experiences are concerned no adverse effects have as yet been encountered in the flavor and general qualities of baked goods produced from refrigerated doughs, provided, of course, that reasonable care was exercised.

* * *

Ernest O. Hense
Illinois

REFRIGERATION SERVICE ENGINEER is quite helpful!

Service Data on
The Crosley Refrigerator

Concluding the Data on T-5 and T-1 Units Continued from the July Issue

Capacitor Trouble

SHOULD a capacitor either short or develop an open circuit, the relay will cut on and off continuously. If the capacitor is suspected of being faulty, it should be tested under actual operation, on another unit known to be in good condition. Delco capacitors, if faulty, should be returned to the distributor's nearest main United Motors Service, Inc. branch for warranty adjustment.

Leaks

Leaks in the T-5 type of unit, whether in the high side or low side, will result in loss of refrigerant, with corresponding reduction of refrigeration and eventually complete cessation of refrigeration. If a leak is suspected, it can sometimes be detected by using a very light grade of oil or soapsuds applied to joints and other likely places. A better method, however, consists of checking the unit with an "Halide torch."

Much time can be saved in locating leaks of Freon-12 by looking for an accumulation of lubricating oil which has leaked from the system. Oil will usually be found where a Freon-12 leak occurs as the oil is miscible with the refrigerant. Use the Halide lamp to definitely locate the leak near the place where the oil was found.

When a leak in a unit is suspected but cannot be located by the above procedure it may be determined whether the unit leaks by carrying out the following procedure:

Place the unit in a shipping box as if it were to be shipped, taking care to see that no cracks or holes are open in the box. Allow the unit to set for a minimum of ten (10) hours. Then drill a hole sufficiently large to permit the Halide leak torch exploring hose to be inserted into the box. The hole should be drilled about half-way up one side of the box provided the exploring hose on the torch is long enough to reach the bottom of the inside of the box. Insert the hose, allowing the end to drop to the bottom of the box, and check for flame color change. This method is very accurate because the gas from a very small leak will collect in the bottom of the box in sufficient quantities over a period of several hours to make a visible change in the flame color. If a change is indicated then the leak may be found by very carefully checking every joint in the system with an Halide torch or liquid soap.

Procedure for Repairing Leaks on T-5 Units in the Field

This method is to be used on units that have *not* lost all of the charge of Freon. In other words, before using this process, be sure that the charging valve adapter gauge shows a distinct positive pressure. This precaution must be taken to be sure that no moisture has been drawn into the unit.

1. Connect about twelve inches of capillary tube to the charging valve adapter on the filter end. The capillary tube is used so that the oil charge is not lost as the refrigerant will be discharged at a slow enough rate so as not to carry the oil along with it.

2. Open the charging valve adapter with key and note the pressure in the unit.

If the pressure in the unit is zero or less, it must be returned to the factory service station for repair.

If there is pressure in the unit, allow it to discharge through the capillary tube.

3. When the pressure in the unit drops to two pounds, remove the charging valve adapter assembly.

4. Leave the charging valve open and proceed to repair the leak as soon as possible. If the leak is in the tube joint, sand and clean the joint until only bright metal shows at the joint. Dig out any pin holes or cracks with a sharp instrument to clean out as much as possible. Apply flux and flow soft solder in and around the leak. This operation must be done as rapidly as possible.

5. As soon as the leak is repaired promptly close the charging valve and put

on the charging valve adapter. Add a sufficient amount of refrigerant in the same manner as for an undercharged unit.

6. Run the unit for thirty minutes and then purge through the float valve any air that may be in the unit.

7. Check the cycling and operation of the unit.

Testing Electrical Circuits

When the unit starts, both windings are across the line; after the compressor is running the starting winding circuit is broken. In case of heavy overload the protective element will break the running winding circuit. Never attempt to open or to service a relay because it is impossible to do this in the field.

In case a unit does not operate, check as follows:

a. First see that cabinet interior light is burning. This indicates voltage at the unit.

b. If there is voltage at the motor the compressor should operate; check this by a slight vibration of the dome. If the compressor does not run listen for clicks on the relay. This clicking noise indicates opening and closing of the relay contacts. This clicking occurs at approximately 40 second intervals on the Delco relay and 3 minutes on the G. E. relay. To test for voltage at the two windings use a test lamp, (110-volt lamp, lamp socket and several feet of two-wire cord will suffice). With the compressor in place, the common motor terminal is at the left side when facing the rear of the unit. This terminal is marked with a red dot and the lead running to it is red colored. The middle terminal or starting winding terminal has no colored dot. The black lead must be connected to this terminal. The terminal to the right is marked with a white dot and is the running or main winding terminal, and must have the white lead connected to it.

c. Attach test lamp to red and white terminals; that is, across the running winding. The lamp should light at least once in a period of three minutes when the house cord is plugged in and the control switch is "ON." Similarly attach test lamp lead to red and black terminals. That is, across the starting winding, as above. This lamp should flash on at least once in a period of two minutes. If on both tests the lamp does not light for a short interval of time, the relay must be replaced. Check your wiring carefully.

d. If both tests indicate a completed circuit, the compresso is "stuck up" or the capacitor is faulty.

e. Pull house cord from the socket, remove the three motor leads from the motor terminals on the dome and replace with clips on the test relay, matching colors. Plug in the test relay (see diagram), to the house socket. This will give an independent check on the compressor. If the compressor will not start this way it must be at fault and the unit must be sent to the factory or nearest factory service branch for servicing. The test relay as shown in wiring diagram may be used on either G. E. or Delco motors.

f. Above all, when working on the relay or the wiring, be sure to have the wiring replaced in the proper manner. It is quite possible to have the wiring reversed and still allow the unit to operate. However, this would mean increased current consumption, the dome would run very hot, and eventually the winding of the motor would be burned out. Check your wiring carefully.

Procedure for Analyzing Troubles in T-5 Unit

Set up unit in test bench and remove dome hold-down bolts. Plug in house cord and turn unit switch to operating position.

If the unit does not operate and no motor hum is heard intermittently, check wiring for an open circuit and the temperature control for discharged bellows or poor contact.

If the motor does hum intermittently as the relay cycles but the motor does not operate, remove house cord plug and connect the testing relay as previously described in this section. If the unit does not operate then there is internal trouble and the unit must be returned to the factory for servicing, but if the unit does operate the trouble will be located in the relay, capacitor, or wiring and may be corrected.

If the motor operates but still no refrigeration, first check high side pressure at float valve port to determine whether the unit is discharged. If normal pressure is indicated heat the condenser with a torch starting at the top and following the tubing down the condenser. If the unit is only slightly short on refrigerant this will start the unit refrigerating, giving one an opportunity to check the charge and at the same time check the system for leaks. If a shortage of refrigerant is indicated and a leak is found, repair as described under "Repairing Leaks on T-5 Units."

If heating the condenser with the motor

running does not start the unit to refrigerating, it is probably so short on refrigerant that the ball in the float assembly will not float. This may be checked with the lift magnet. If when using the lift magnet the small tube leading from the float valve to the upper evaporator shelf is cooled it indicates that the trouble is either a sunken float ball or that the unit is almost completely discharged. In order to determine whether the unit is discharged or has a sunken float ball open the purge valve. If liquid refrigerant passes, the trouble is undoubtedly a sunken float ball, but if only gas is blown out it indicates the unit is almost discharged. The entire system should be tested for leaks in this case and repaired.

If when using the lift magnet no refrigeration is indicated on the small evaporator inlet tube and the unit has refrigerant in it, the indication is that the float valve orifice is restricted. This condition will also permit liquid refrigerant to be discharged when the purge valve is opened. In this case the unit must be returned to the factory for service.

Servicing Units with T-1 Compressor 1937

Units employing the T-1 compressor are of the semi-hermetically-sealed type, with still air condenser and a capillary tube as a means of refrigerant flow control. It is not recommended that T-1 units be serviced by the dealer or distributor where the refrigerating system is affected; instead, such servicing must be done by The Crosley Radio Corporation factory or by one of its designated service depots. Of course, such parts as the temperature control, evaporator front, relay and other separate items, can be readily replaced in the field. The T-1 compressor is of the reciprocating type, with forced-feed oiling. The motor rotor and shaft are supported by two bearings, and the motor is a ⅛ hp. capacitor start type with hot wire start and overload relay.

Evaporator

The evaporator used on 1937 T-1 units, except Models HB1-30 and HB1-31, is constructed of steel stampings, comprising an inner and an outer shell, so stamped as to form a continuous tube when assembled and welded, with a large expansion head on the upper left side connecting to the low side suction line and a small inlet fitting on the upper right side, into which is connected the capillary tube. The evaporator shelves for the ice trays are made of plate copper and the evaporator is "U" shaped in construction.

Condenser

All T-1 models have a single-section finned type condenser which mounts on the back of the cabinet, including the bottom-mounted models, HB1-30 and HB1-31. The large size of the condenser provides ample cooling surface and the wide spacing of fins allows air to travel freely between the fins, which prevents the common trouble of dirt collection.

Compressor

The Crosley T-1 compressor is of the reciprocating piston type, semi-hermetically sealed, with its motor in a heavy sheet metal housing. The housing consists of a dome base, to which the compressor assembly is rigidly fastened, and a one piece drawn dome. These two members are fastened together at a flanged joint on a lead alloy gasket by 24 heat treated bolts.

The capacitor start motor stator is fastened into the lower frame by two stator clamps and two screws. An upper motor frame is fastened to this lower frame and is maintained in perfect alignment by a flanged joint on the common face of the two frames. Each frame is machined for a shaft bearing which is Heald bored and bearingized to a mirror finish. Both frames are semi-steel castings. The two frames actually form both the motor-compressor shaft bearings.

Filter Dryer

The filter dryer is placed between the condenser and the capillary tube. The dryer serves two purposes—first to keep the refrigerant dry, and second to screen the liquid refrigerant before it passes through the capillary tube.

The three screens have the same fine mesh as those used in the filter of the conventional, or "Q" unit. The drying agent used in these assemblies is activated alumina. This substance will very effectively absorb water and prevent the formation of sulphurous acid.

Capillary Tube

The capillary tube in the T-1 unit is similar in every respect to that used in the "Q" or conventional type unit.

Capacitor

The capacitor employed in the T-1 unit is similar to that used on the T-5 units and

serves the same function; therefore the description of this part will not be repeated.

Temperature Control

The temperature control on the T-1, like that used on T-5 and "Q" units, consists of a thermostatic switch operated by means of a gas-filled tube and bulb system.

Testing the Relay

The relay is of the hot wire start and overload type. When a unit starts, both windings are across the line. After the compressor is running, the starting winding circuit is broken. The relay also serves to

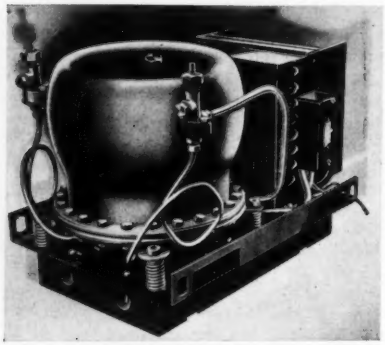


FIG. 6.—T-1 CROSLEY UNIT

allow full use of the motor output, but in case of heavy overload will break the running winding circuit.

Never attempt to open or service a relay, as it is impossible to do this properly in the field. All relays are sealed.

In case a unit does not operate, check as outlined below:

a. First see that cabinet interior light is burning. This indicates voltage at the unit.

b. If there is voltage at the relay, the compressor should operate. Check this by slight vibration of the dome. If compressor is not running listen for clicks of relay. These clicks indicate opening and closing of both circuits and occur at approximately 40 second intervals. To test for voltage at the two windings, use a standard test lamp. A 60-watt, 110-volt light bulb in a standard light socket to which several feet of two-wire cord is attached, will suffice. With the compressor in place the common terminal is to the left; it will have a red dot on the terminal lug. The red lead of the three-wire cable must go to this lug. The middle lug has no colored dot and takes the black lead. This is the starting winding. The lug on the right has a white dot and is the running winding lead. This takes the white lead wire.

c. Attach test lamp leads to the red and white terminals; that is, across the running winding. The lamp should light at least once in a period of two minutes when the house cord is plugged in and the control is "ON." Similarly, attach test lamp leads to red and black terminals; that is, across the starting winding, as above, and the lamp should flash on at least once in a period of two minutes. If on both tests the lamp does not light for a short interval of time, the relay must be replaced. Check wiring carefully.

d. If both tests indicate a complete circuit, the compressor is either trying to start against a high condenser pressure or the compressor is stuck-up. Test head and back pressures with unit "off." These should equalize to within several pounds of each other. If the head pressure does not drop in several minutes time to the same as the

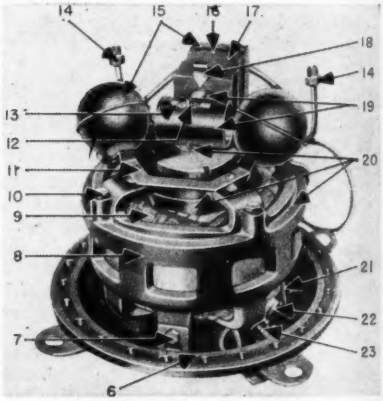


FIG. 7.—OPEN VIEW OF T-1 UNIT

6—Dome Base Assy.	14—Flare Connectors
7—Base to Frame Screws	15—Head and Muffler Assy.
8—Lower Motor Frame	16—Valve Plate Assy.
9—Slator	17—Cylinder
10—Motor Frame Screws	18—Oil Drip
11—Muffler Bracket	19—Piston
12—Oil Spout	20—Rotor, Shaft and Frame Assy.
13—Cross Head	

21-22-23—Terminal Assy.

evaporator pressure, check for a plugged condition in the condenser or capillary tube.

e. If pressures equalize, test compressor with a test relay. Pull house cord from socket. Remove three-wire cable leads and replace with clip leads, matching colors. This will give an independent check on the

compressor. If the compressor will not start it is definitely at fault and unit must be replaced.

f. The relay might possibly allow the starting winding to cut back into the circuit while the unit is operating. This will cause higher power consumption and a hotter dome than usual. In time this condition could burn out the starting winding. Under this condition the relay will click while the unit is running normally. This will cause lights on the same circuit to dim and the motor hum to increase when the starting winding is in. To check, put test lamp across black and white terminals. This lamp should burn continuously. If it goes out and then comes on again during the running period of the unit, the relay should be replaced.

g. Above all, when working on the relay or the wiring be sure to have the wiring replaced in proper manner. It is quite possible to have wiring reversed and still have the unit run. However, this would cause twice the amount of power consumption, will cause the dome to run hot, and mean burned out windings.

Concluded

Thirteenth Article

Air Conditioning

The A.C. Motor Used on General Electric CM5-W Refrigerating Machines

By W. C. FARMINGDALE

THE a.c. motor used on the 1934 Model CM5-W refrigerating machine is a special type capacitor-start, capacitor-run motor. This motor must be used with a special starting relay and two capacitors, one a 5 mfd. continuous duty type, the other a 14 mfd. intermittent duty type.

Occasionally troubles develop in the capacitors or in the relay. Hence, it is necesssary that service engineers know how this circuit works so that they can quickly locate sources of trouble.

Because the relay and the capacitors are crowded into a very small space at the right bottom of the unit, and because the wires are so short, it is a hard job to work on the electrical circuit of this machine. Hence, it is almost essential that the serviceman knows just how the circuit works so that he can locate the trouble without removing the relay and capacitors from the refrigerating machine.

The Motor

The motor used on the CM5-W refrigerating machine is different from the conventional capacitor motor used on refrigerating machines.

The conventional capacitor motor is of the capacitor-start-induction-run type. The field of this type motor consists of two windings, one the starting (capacitor) winding, the other the running winding. The starting (capacitor) winding is generally made of small size wire, whereas the running winding is wound with larger wire. The starting winding is used only when the motor starts; hence, when the motor gets up to speed, the

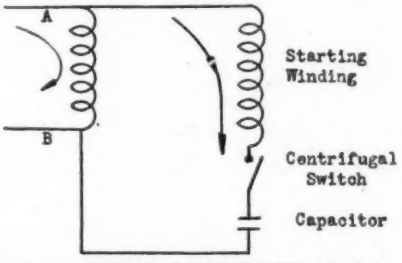


FIG. 1.—WIRING DIAGRAM OF CONVENTIONAL MOTOR

starting winding is disconnected by means of a centrifugal switch shown in Figure 1.

Figure 1 shows the schematic diagram of the conventional type of capacitor motor. In this diagram, current flows into the circuit at A, through the running winding and out at B, as shown by the single headed arrows. Current also flows from A through the starting winding circuit, through the centrifugal switch, through the capacitor

and out of the circuit at B, as shown by the double headed arrows.

When the motor gets up to speed, the centrifugal switch opens and stops the flow of current through the starting (capacitor) winding.

On the CM5-W motor, the capacitor

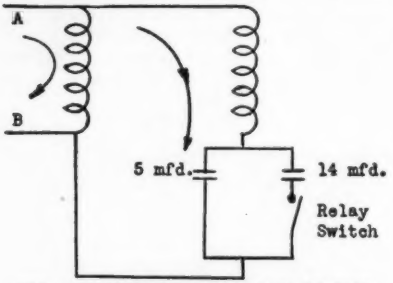


FIG. 2.—SCHEMATIC DIAGRAM OF THE CM5-W MOTOR

winding is made of comparatively heavy wire, whereas the running winding is made of comparatively fine wire. Figure 2 shows a schematic circuit diagram of a CM5-W motor. In this diagram, current flows into the motor at A through the running winding and out of the circuit at B, as shown by the single headed arrows. Current also flows through the capacitor winding, through both of the capacitors and out of the circuit at B.

When the motor is up to speed, the magnetic switch (in the relay) cuts the 14 mfd. capacitor out of the circuit, but leaves the 5 mfd. capacitor in the circuit. Hence, after the motor is up to speed, both windings carry current and one capacitor is left in the circuit. The 14 mfd. capacitor is of the intermittent duty type because it is in the circuit only about four seconds at a time. The 5 mfd. capacitor, on the other hand, is of the continuous duty type because it is used all the time that the motor is operating. When ordering replacement capacitors it is essential that you specify for what duty they will be used.

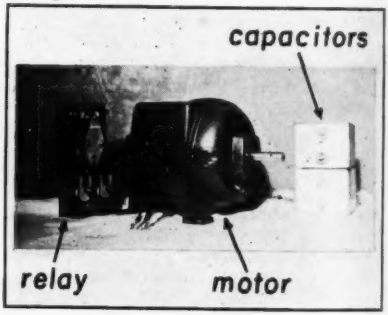
The Complete Circuit Diagram of Motor Capacitor and Relay

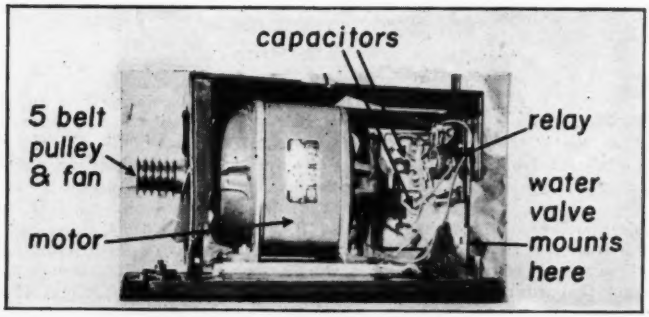
Figure 3 shows a picture of the motor, relay and capacitors used on the Model CM5-W Machines, and Figure 4 gives a point to point wiring diagram of the complete electrical circuit. The wires in this diagram are connected just as they are on the unit.

In order to simplify the study of this circuit, the schematic diagram in Figure 5 was drawn.

In this diagram current enters at A and flows through the two relay coils L and M and out of the circuit at B, as shown by the single headed arrows in Figure 5. As a result the coils become magnetized and close the contacts in switches N and O.

Then current flows from A to the red lead on the motor, through the running winding of the motor, out through the white lead on the motor, through switch N back to the line B, as shown by the double headed arrows in Figure 5.





FIGS. 3 and 3A — showing compact space in which motor capacitors and relay are mounted. The water valve has been removed to expose the bottom capacitor. In the top picture the motor capacitors and relay panel are shown separately.

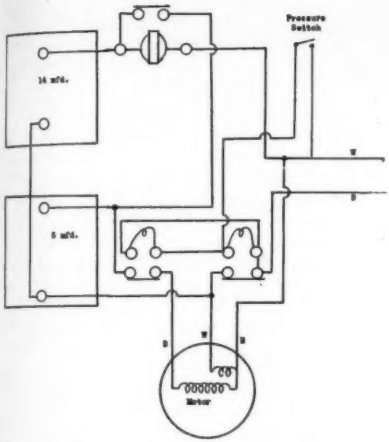


FIG. 4—Point to point wiring diagram of CM5-W

As shown by the triple headed arrows in Figure 5, current also flows from A, through the red lead of the motor, through the starting winding, through switch O, through the 5 mfd. capacitor, back through switch N to the line at B. Then, too, part of the current through the starting winding flows through switch P, through the 14 mfd. con-

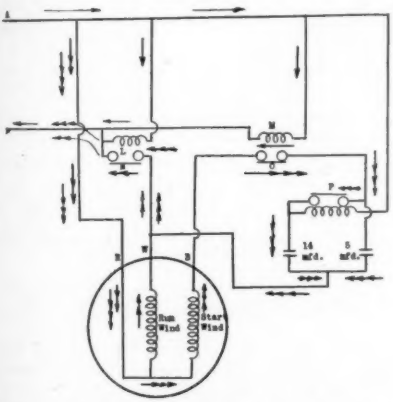


FIG. 5—Wiring diagram showing path of current when motor starts

denser and back to the line at B, as shown by the triple arrows in Figure 5.

Thus, in the starting position of the relay, current flows from the line A, through the starting winding and then through both capacitors back to the line at B.

Switch P

Switch P is known as a disconnect relay; that is, when the clapper arm on switch P is pulled in by the magnetism from its relay coil, the clapper arm breaks the circuit through the switch contacts.

Now, in this circuit, the iron clapper is in the open position and is quite a distance from the iron core of the relay coil. This distance is so great that about 350 volts are required on the relay coil in order to produce enough magnetism to bring the clapper

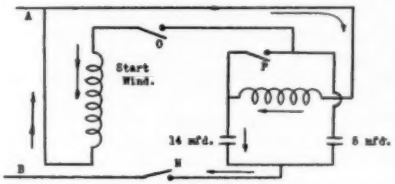
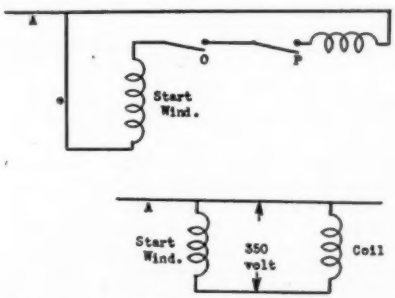


FIG. 6

arm up to the iron core of the relay. However, once the clapper arm is moved up to the relay core, sufficient magnetism is produced by 220 volts on the relay coil to hold the clapper in position. This fact must be realized or else the serviceman may spend needless time adjusting the relay when the trouble with a machine lies outside the relay altogether.

Now, to understand the function of relay P, let's see how this relay is connected to the circuit. First, let's study Figure 6, which is nothing more than the relay circuit lifted right out of Figure 5.



FIGS. 7 and 7A

Current flows from line A, through the coil of relay P, through the 14 mfd. capacitor, through switch N back to line B, as shown by the single headed arrows in Figure 6. Now, since the line voltage is only 220 volts, sufficient magnetism is not created in

the relay coil to bring the relay clapper up to the coil. Hence the switch contacts at P remain closed. Now, notice that one side of the starting winding is connected to line A and that one side of the relay coil is connected to line A. Then the other end of the starting winding is connected to the other end of the relay coil, as shown in Figure 7 and 7A.

Now when the motor is starting, the voltage across the starting winding is comparatively low, but as soon as the motor gets up to about 75 per cent of full speed, because of an interaction between the 14 mfd. capacitor and the starting winding, the voltage across the starting winding builds up to about 350 volts. Since the relay is connected across the starting winding, as shown in Figure 7, the 350 volts from the starting winding is applied across the relay. When this happens, the relay coil attracts the clapper arm on switch P and the clapper arm breaks the switch contacts. As soon as this happens the 14 mfd. capacitor is disconnected from the starting winding circuit

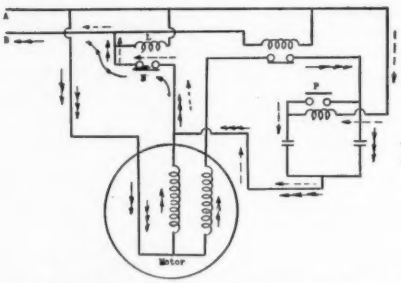


FIG. 8.—Path of Current Through CM5-W Wiring Circuit in the Running Position

and the high voltage reaction on the starting winding disappears. However, the relay coil is still connected to the line through the 14 mfd. capacitor, so that the clapper arm stays in even though the high voltage is no longer applied across the coil.

When the clapper on switch P is in, the circuit diagram becomes as shown in Figure 8. In this diagram you can see that current flows through the running winding as indicated by the double arrows in Figure 8 and through the starting winding by the triple arrows. Notice the starting winding current passes only through the 5 mfd. capacitor, as shown by the dotted arrows. On this diagram you can see that current flows from the line at A through the coil of relay P, through the 14 mfd. capacitor, through switch N and out to the line at B. This current magnetizes the coil of switch P and keeps the 14 mfd. capacitor disconnected while the motor is running.

Overload Protection

Overload protection is needed on all high torque capacitor motors, but especially on the motor used on the CM5-W. If the motor should become momentarily overloaded and stall, the switch P would remain open and, even if the overload should disappear almost immediately, switch P would remain open so that the 14 mfd. starting capacitor would be out of the circuit. As a result, the motor would not start, and would soon burn out. On a conventional capacitor motor, the centrifugal switch would reconnect the starting capacitor as soon as the speed fell off and thus allow the motor to restart. Then, too, in case the relay coil in switch P should become open circuited, switch P would not open and disconnect the 14 mfd. capacitor when the motor was up to speed. Because of the high current flowing through the 14 mfd. capacitor the starting winding would soon burn out.

Some air conditioning manufacturers used a General Electric C-R switch to provide overload protection to the CM5-W machines. The C-R switch is a non-conven-

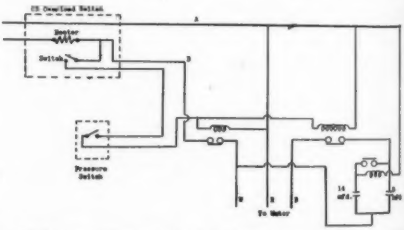


FIG. 9.—Showing the C-R Switch used as Overload Protection on CM5-W Machine

tional overload protector in that it is connected in two separate circuits. Here's how it works.

As shown in Figure 9, three terminals are located on the switch. Two of these terminals are on either side of a heating coil and are connected in series with the line. Thus they carry the full line current. The third terminal is connected in series with a low ampere switch. When an overload occurs, the heavy current passing through the heating coil melts the solder on a cog and allows the switch contacts to open.

The C-R switch is connected to the CM5-W circuit, as shown in Figure 9. The

line comes into the C-R switch box. One side of the line (A in Figure 9) passes through the box to one side of the motor circuit. The other side passes through the resistance of the C-R switch. A line runs from the resistance to one side of switch N and from here directly to the motor windings. Another line runs from the switch side of the C-R switch to one side of coils L and M. In case of an overload the switch contacts in the C-R switch open and break the circuit to coils L and M. As a result switches N and O open and disconnect the motor windings from the line.

Experience shows that this arrangement of parts is not altogether satisfactory. In case a ground should develop in switches N or O, the fuse feeding line B would blow out. However, line A would be unaffected and as a result the motor would receive 110 volts instead of the 220 volts required. Because the overload protection is located in line B, which is grounded, the overload protector would be inoperative. As a result the motor would stall and burn out. Because of the compactness of the CM5-W assembly and because of the nearness of the relay assembly to the water valves, a ground will develop on an occasional CM5-W and cause the motor to burn out.

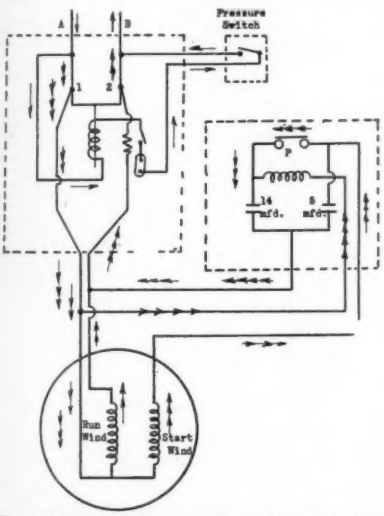


Fig. 10—Revised Circuit using an across the line starter in place of relays N and O in Fig. 5.

To get around the situation the writer recommends that a solenoid across-the-line type of starter be used in place of relays N and O. When this is done, the circuit becomes as shown in Figure 10.

In this circuit, current flows in through A, through the solenoid coil of the starter, through the overload protector switch, through the low pressure switch on the refrigerating machine and out line B, as shown by the single headed arrows in Figure 10. The solenoid coil becomes magnetized and pushes contacts (1) and (2) up to the two line posts on the starter. Then, as shown by the double arrows, current flows from line A, through contact (1), through the running winding of the motor, through the overload heater element, through contact (2) to the line at B. As shown by the triple arrows, current also flows from line A, through the starting winding, through the 5 mfd. capacitor back to line B and, when switch P is closed, current also flows through the 14 mfd. capacitor to the line B. When the motor is up to speed, switch P opens and then current can no longer flow through the 14 mfd. capacitor.

As explained before, switch P is held open after the motor is up to speed because current flows (as shown by the four headed arrows) from line A through the coil P, through the 14 mfd. capacitor to the line at B.

S S S

R. E. Stormer
Iowa

Enclosed find check for $3.75, for which please send me three binders for the valuable copies of the R.S.E. Any magazine with as much information as this is entitled to a nice cover.

Last Monday morning, I had a call on a Coldspot refrigerator. This being my first opportunity to work on one of this make, I was a little bit puzzled. When I brought the unit into the shop, there was my late copy of R.S.E. with all the information on the Coldspot refrigerator—just what I wanted to know.

Melvin Sexton,
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I wish to renew my subscription to THE REFRIGERATION SERVICE ENGINEER for another year. You truly have a fine publication. Enclosed find subscription price ($2.00).

I. Mayr,
Illinois.

Thank you for all the very valuable information we receive in your Question Box.

Design Data on
The Thermostatic Expansion Valve

Needles and Seats

By GEO. H. CLARK*

ONE of the early troubles that developed with both automatic and thermostatic expansion valves was the matter of leakage by the needle and seat. Whereas the valves might be holding perfectly while new they might develop leaks after a very short period of service or the leakage might not be serious for a matter of several years.

This early trouble might be attributed to both erosion and corrosion. Erosion of course consists in the wearing away of the metal due to the flow of the refrigerant with whatever might be contained in the refrigerant. This wearing away at a throttling point is also referred to as wire-drawing.

Corrosion is the eating away of the metals due to chemical reactions taking place. Theoretically if the refrigerant contains no acid or moisture there should not be any corrosion with the metals commonly used. Actually there seems to be no such thing as a non-corrosive system. Some are considerably worse than others but the corrosion free system probably doesn't exist.

Erosion may be eliminated to a large extent by using hard metals. Expansion valve needles then have been made of very hard materials including various types of stainless steels and such hard materials as stellite. The problem of producing hard needles is not a particularly difficult one as this is principally a grinding job and the hardest of metals can be ground smoothly and without difficulty. The seats however are a different proposition. In general the easiest way to make a round hole in a piece of metal is to drill it. Certainly it would be a difficult job to grind a hole one thirty-second of an inch in diameter in a piece of hard metal.

In order to drill a hole it is necessary to have a piece of metal which is not as hard as the drill. Drilling a hole in a piece of stellite to produce expansion valve orifices would certainly be commercially impractical. Consequently the seat material was generally some material fairly hard but still soft enough to be drilled.

The valves for a time were thus composed of a very hard needle and a moderately hard seat which involved the use of two different metals. The erosion and corrosion both take the greatest effect where the refrigerant velocity is highest. If the point of high velocity is between two metals which are unlike ideal conditions for corrosion are obtained.

Corrosion is largely a matter of electrolysis. In this case corrosion is the eating

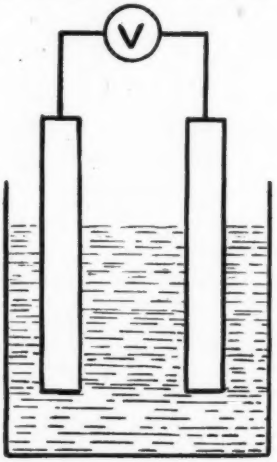


FIG. 1

away of the metal due to the establishment of a minute electrical circuit very similar to that which obtains in an electric circuit containing a dry cell. Figure 1 shows a container being partially filled with a salt or acid solution. If two metals are partially immersed in the solution and a voltmeter "V" connected across the two metals a voltage would be indicated. The voltage of course would be very low and would depend upon the metals used. If the two metals were very close together in the table of chemical activity the voltages produced might be only a few millivolts. If the

* Refrigeration Engineer—Detroit Lubricator Co.

metals were far apart in the table of chemical activity the voltage might get up to over one volt. In the case of the usual dry cells a solution of sal ammoniac is used and one of the metals is zinc which rates as a very active metal while the other is carbon which is quite inactive as compared to most of the other metals. With this combination about one and one-half volts may be produced across the terminals. If the two terminals are connected together externally through some device such as a light bulb the voltage produced causes a current to flow through the filament causing it to heat and glow.

Eventually the dry cell wears out, in which case it will be noted that the zinc is pretty

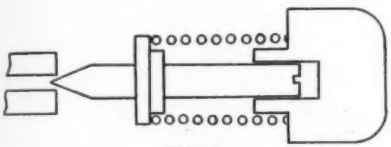


FIG. 2

well eaten out. This is essentially the same thing that occurred in expansion valves and caused the breaking down of the valves. In referring to Fig. 1 again, if both pieces of metal were the same there would be no difference in chemical activity and thus no voltage set up. Consequently materials were sought which could be used for both needles and seats so as to minimize corrosion at this point.

Figure 2 shows one of the early methods employed in guiding the needle into the seat. In this case the needle has a collar on it against which the needle-closing spring pushes. Actually it is a practical impossibility to obtain springs commercially which will push absolutely in a straight line parallel to their axis. The result was that the needle would not move straight into the seat but would tend to wipe on one side of the seat allowing most of the refrigerant to pass by the other side. This action caused all the needles to become pitted on one side, and thus cut down their life.

Figure 3 shows a method employed by Detroit Lubricator to make the needle go straight into the seat so that a perfect circle closing is obtained tending to prolong the leak-proof life of the valve. The first time the needle enters the seat it may tend to wipe on one side of the seat but the needle assembly is so constructed that the needle, once centered, will pull straight out and go straight back in with no further wiping action. This lets the refrigerant spray through the valve orifice all around the needle rather than just around one side.

There are a number of other types of construction employed which produce essentially the same results all acting to increase the life of the valve.

Bellows Material

After the valves were improved to have a longer life at needle and seats the next serious trouble to be remedied was the occa-

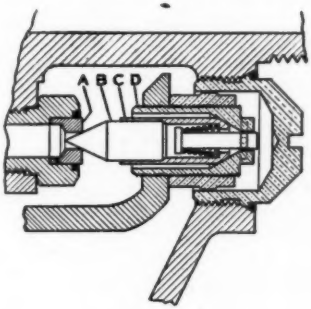


FIG. 3

sional bellows failure. The bellows were at first made of brass and, although many of them gave years of service with no difficulty whatever, too many of them broke down with consequent loss of refrigerant from the refrigerating system itself.

The cause of the breakdowns is not definitely known. It has been described as inter-crystalline-corrosion which may be just a high-class way of saying we don't know what it was. One possibility that occurs is that the story of one chemist is correct in saying that the Bakelite spacer used between the power element and the valve releases some ammonia gas which in the presence of moisture attacks the brass.

Whatever the cause of this particular difficulty, it was remedied by using a different type of material.

S S S

O. C. Schafer
Illinois

You will find enclosed, my check for $2.00 for subscription to THE REFRIGERATION SERVICE ENGINEER. I read every copy very thoroughly, and find a lot of good information that in many cases would be difficult to obtain elsewhere. I keep all copies filed for future reference.

Estimating Loads Involved in Dairy Systems

By L. K. WRIGHT

ALL milk contains bacteria, despite the utmost care in milking. It is therefore necessary to chill it as soon as it is drawn from the cow to prevent further propagation and increase in bacterial count. Some milk stations, to whom the dairyman disposes of the milk and cream, offer bonuses for low bacterial counts. It is to the interest of the farmer to have as pure a product as possible if he sells to the creameries.

Most states and districts have stringent laws relating to sanitary methods and milk specifications. The farmer who sells direct to consumer must have his own pasteurizing plant so the milk can be heated rapidly to 140-145 degrees F. (generally 142 degrees F.) The milk is held at this temperature for upward of 20 minutes, when it may be cooled and bottled.

The pasteurization process kills most of the bacteria, especially the harmful types and, with proper handling, the milk will remain in proper condition for human consumption.

It is essential to cool the milk as rapidly as possible after pasteurization, as the butter globules are very tender at high temperatures. If overheated, the globules will break and the milk will have a cooked taste. Should the globules break or separate, either through overheating, delay in cooling or not being chilled rapidly enough in the cooling process, the butter content will mix with the milk and cannot be separated again. Such milk could not be used for creamery purposes. Again, customers would think such milk of poor grade, as the cream line in the bottles would be scanty, despite the fact that actual analysis might prove the product to actually be richer in butter fat and contain less bacteria than the code provides for.

Milk leaving the pasteurizer may have a great deal of heat removed by tubular surface coolers or the double-pipe counter-flow type, using well or spring water for the purpose. With sufficient water at a temperature of 75 degrees F. or lower, the water cooling or top section of the milk cooler will reduce the temperature of the milk to about 80 degrees. This reduction of milk temperature, from 142 degrees to 80 degrees F. (142—80= 62 degrees drop) is considerable and if water is available it should be used, instead of throwing this load on the refrigerating equipment. The size of the machine will be cut to less than half where water cooling is resorted to.

Example

In order to provide an easy method of estimation, an example using 100 gallons of milk as the basis will be used. Thus, a 50 gallon installation, or one of any gallonage, can be easily proportioned by direct reference to the data.

The example will therefore assume the cooling of 100 gallons of milk per day. This milk is to be pasteurized at 142 degrees F. and must be cooled immediately. In flowing from the pasteurizer to the water-cooled section of the milk cooler, the milk will be slightly cooled and the temperature of the milk arriving at the cooler will be taken as being 140 degrees F.

The weight of milk is 8.6 pounds per gallon and its specific heat 0.935. Inlet water arriving at the cooler will be taken at 75 degrees F. Many farms having recourse to spring water will be able to obtain water of much lower temperature than this. Outlet water temperature will be taken as 95 degrees F. Water weighs 62.27 pounds per cubic foot but for estimating assume 62.5 pounds.

One cu. ft. of cooling water rising from 75 degrees to 95 degrees F. will absorb:

$$(95—75) \times 62.5 = 1{,}250 \text{ B.t.u.}$$

To cool 100 gallons of milk from 140 degrees F. to 80 degrees F. requires the extraction of the heat load involving:

Gal. Milk × Weight per gal. × Temp. Difference × Specific Heat

Thus:

$100 \times 8.6 \times (140—80) \times 0.935 = 48{,}246$ B.t.u.

As one cu. ft. of water was found to be capable of taking up 1,250 B.t.u., the number

of cu. ft. of cooling water required for this cooling problem would be:

$$48{,}246 \div 1{,}250 = 30.6 \text{ cu. ft.}$$

If the cooling is to be done in one hour the full 30.6 cu. ft. will be required. If two hours is the allotted time only half this quantity per hour will be required.

The requirements per minute would be—

$$30.6 \div 60 = .51 \text{ cu. ft. per minute}$$

where cooling must be accomplished in one hour. For two hour cooling period the requirements would be:

$$\frac{30.6}{2 \times 60} = .255 \text{ cu. ft. per minute}$$

Where gallons are required, multiply result by 7.48 for accurate work. For rough estimates and a slight factor of safety use 7.5.

Thus, for one hour cooling period the gallons per hour would be:

$30.6 \times 7.5 = 229.5$ gal. per hour

Or, for gal. per minute, divide by 60, thus:

$229.5 \div 60 = 3.8$ gal. per minute

From this data the correct pump can be selected for the water cooling estimate. Make sure the pump actually handles this quantity as this amount of water is the actual requirement. Consult the manufacturers data concerning the pump decided upon. Then check friction losses so that the pump selected will handle the proper quantity of brine.

Milk Cooling By Machine

The load to be imposed on the refrigeration unit can be estimated by the following formula:

$$G \times W \times TD \times SH = \text{total B.t.u.}$$

in which, G = Gal. milk (100 Gal.)
W = Weight per gal. (8.6 lb.)
TD = 80 deg. to 40 deg. F. = 40 deg. Temperature Difference
SH = Specific heat of milk = 0.935

Thus, the load on machine will be:

$$100 \times 8.6 \times 40 \times 0.935 = 32{,}164 \text{ B.t.u.}$$

If a direct expansion cooler is used it must be capable of extracting this heat load within the given cooling time. Where the cooling time is two hours half the capacity is necessary for the per hour run.

Let us assume the lower part of the milk cooler will be cooled by brine. Use of brine permits a smaller and cheaper refrigerating unit. For these reasons let us assume a brine job. It is necessary to find the quantity of brine needed for circulating through the cooler.

Brine

As a rule a 20 per cent calcium chloride brine will be found satisfactory. Such a brine has a specific gravity (at 60 degree F.) of 1.179, a freezing point of 1.5 degree F., weighs 73.53 pounds per cu. ft. and has a specific heat of 0.834.

Assume brine will enter cooler at 25 degrees F. and leave at 40 degrees F.

One cu. ft. of this brine will therefore take up:

$$(40-25) \times 73.53 \times 0.834 = 920 \text{ B.t.u.}$$

As 32,164 B.t.u. forms the load, the number of cu. ft. of brine required can be estimated as:

Load = 32,164
Pump and line losses, at 10 per cent, = 3,216 or a total load of 35,380 B.t.u.

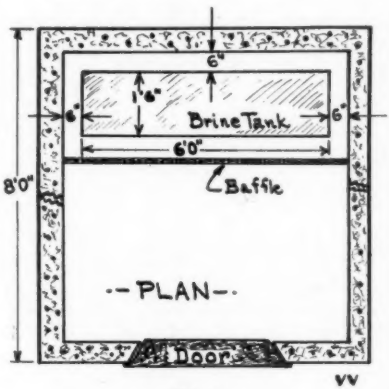


FIG. 1

$$\frac{35380}{920} = 38.44 \text{ or } 38.5 \text{ cu. ft. of brine}$$

Milk Box

Milk bottling plants require roughly about 350 cu. ft. of space per 100 gal. of milk stored.

Thus, a box of about $8 \times 6 \times 7$ feet high would serve the purpose. If, however, this box is to be cooled by the brine tanks, instead of having to insulate the tank and provide separate coils in the box, it is best to assume a box $8 \times 8 \times 7$ feet high, so that there will be room for the brine tank. This makes a cheaper and better job.

The outside surface of such a box would be 352 square feet. This is for six sides, considering top and bottom as a "side". The box is best insulated with four inch sheet

cork, using ⅞ inch sheathing on both inside and outside walls, thus providing a wall having a total thickness of six inches. The insulation leakage factor (K) in B.t.u. per square foot per degree difference per 24 hours is 3.5 for such a wall.

An outside temperature of 80 degrees F. will be assumed. Such a temperature is perfectly allowable in northern localities but for central states use 90 degrees F. and for southern locations, 100 degrees F.

The temperature inside the box will be taken as 40 degrees F. The temperature differential between inside and outside temperatures is thus found to be:

$$80 - 40 = 40 \text{ degrees TD}$$

A usage factor to allow for opening of doors, lights, etc. must be allowed, which will be taken as 1.20.

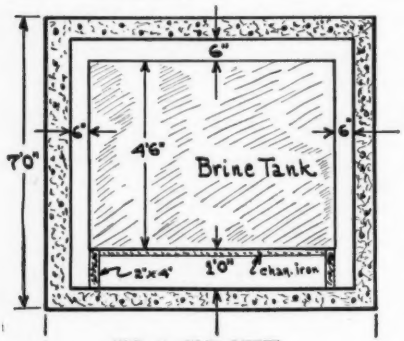


FIG. 2—END VIEW

The load of such a box will be:

$$S \times TD \times U \times K = \text{B.t.u.}$$

Where, S = surface, sq. ft. (352)
TD = 40 (80—40) Temperature Differential
U = Usage factor (1.20)
K = Leakage factor (3.5)

The box load amounts to:

$$352 \times 40 \times 1.20 \times 3.5 = 59{,}136 \text{ B.t.u. per 24 hrs.}$$

Brine Tank Surface

As a brine tank will be used to cool the milk and take care of the box load it is necessary to find out the tank surface needed.

Assume a heat transfer factor of 2.75 per hr. per degree between tank surface and the box air. The brine will be assumed to be held at about 25 degrees F., ready for delivery to the milk cooler when required. Temperature differential is 40—25 or 15 degrees F.

The amount of surface required may be determined by the following calculation:

$$\frac{59{,}136}{2.75 \times 15 \times 24} = 60 \text{ sq. ft.}$$

If the tank to be used is given clearance on each end—a six inch clearance at top and 12 inches from floor, one that is 4.5 feet high by six feet long can be used. Disregarding the bottom surface, which is not very active in cooling anyway, such a tank will provide the necessary cooling surface. As brine for the milk cooling problem is required, this tank must be large enough to hold this quantity. As 38.5 cubic feet is the requirement, if we made this tank one foot six inches wide it would have ample volume and surface. Roughly, it would have a volume of about 40 cubic feet, as coils must be immersed in the brine and the brine is never carried right to the very top of the tank. Such a tank should be set on rails, six inches away from one of the long walls. This will leave the remainder of space for milk storage. A baffle should be placed before the tank to assure proper convecting currents in the box, as well as offer protection to the tank.

Brine Coils

Extra heavy steel pipe is generally used in brine tank jobs. There are 2.9 lineal feet of one inch pipe and 2.301 lineal feet of 1¼ inch pipe to the square foot of surface.

For a large coil use 1¼ inch pipe. For a small job, such as the one being estimated, use one inch extra heavy steel pipe.

The amount of coilage required may be determined by the following formula:

$$\frac{\text{total B.t.u.} \times \text{pipe factor}}{\text{hr. of operation} \times \text{temp. diff.} \times \text{heat transfer coefficient}}$$

Thus, there would be required, if the machine is estimated to run 12 hours per day, the following:

Total B.t.u. = milk cooling + box cooling, or

$$48{,}246 + 59{,}136 = 107{,}382 \text{ B.t.u.}$$

Temperature differential will be assumed to be about 30, estimating vaporization at about 10 and brine at 40.

Heat transfer coefficient for one inch pipe will be taken as six per hour per degree difference in still brine.

Therefore, the problem resolves itself as:

$$\frac{107{,}382 \times 2.9}{12 \times 30 \times 6} = 145 \text{ lineal ft. of 1 in. pipe}$$

Such a coil can be made up in the common

oval shape, leaving about four inches clearance at the ends and about two inches clearance at the sides. A coil about five feet two inches long by 14 inches wide is therefore to be made up, containing the required pipe.

Size of Machine

We found the total load was 107,382 B.t.u. per 24 hours. Assuming the machine is to run 12 hours per day, its size or capacity would have to be:

$$107{,}382 \div 12 =$$

8,949 B.t.u. per hr.

Now a one-ton unit is one capable of doing 288,000 B.t.u. per 24 hours or 12,000 B.t.u. per hour of operation. Therefore, the machine required is:

$$\frac{8{,}949}{12{,}000} = .74$$ or roughly a ¾ ton unit

Such a unit will be powered by a two or three H.P. motor. This size of motor is well adapted to current conditions in the country-side. Of course many plants are operated by gasoline or kerosene engines, independent of such hazards as inability to operate because of storms or because lines are down.

Resume

From the data given a dairy of any size can be quickly estimated. The use of water over the "hot" section of the milk cooler is advocated, as it cuts down the size and cost of the refrigeration unit—a point which the farmer is particularly interested in.

For other data pertaining to the estimation of dairy jobs refer to the book "Commercial Refrigeration," by L. K. Wright, published by Nickerson & Collins Co., of Chicago, Illinois.

Importance of Baffle

Baffles are essential. They provide the proper channel effect for air circuits and when correctly made and installed will assure positive convecting currents. Poor baffling or incorrect spacing will hinder air flow.

Fig. 1 shows a plan view of the job. Spacing of the brine tank from the side and end walls can be checked on this sketch, while Fig. 2 provides an end view, so that

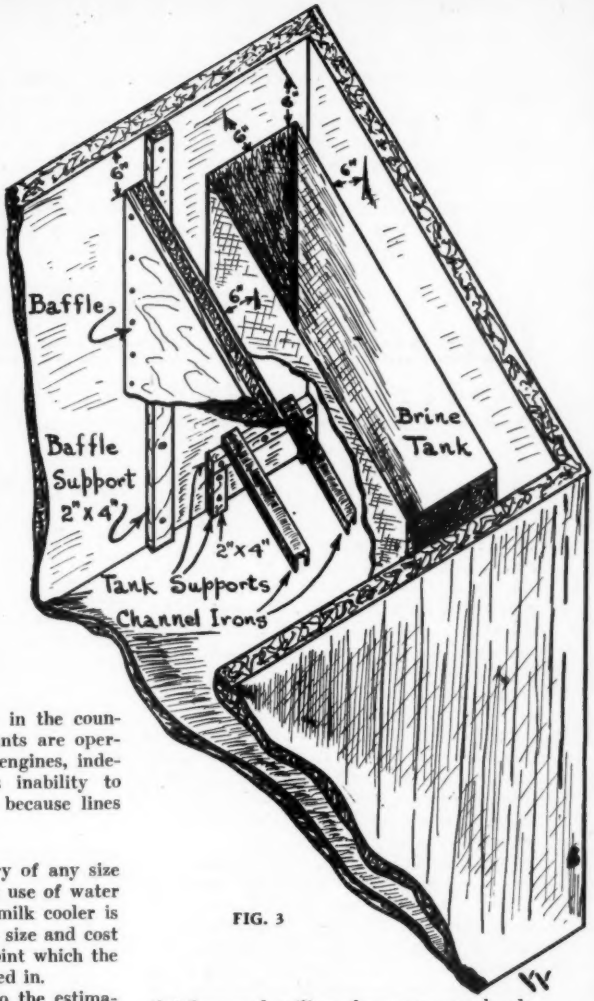


FIG. 3

the floor and ceiling clearances can be determined.

The brine tank is best mounted on two or three galvanized channel irons, the latter supported by 2 inch × 4 inch supports nailed to the end walls. Fig. 3 provides a cutaway view of the installation showing the tank and its supports.

It is suggested the baffle be made of ⅞ inch tongue and groove with a ¾ inch thickness of some "blanket" type of insulation between the sheathing faces. Use insulation paper between the sheathing and insulation, as a seal and protection to the insulation. Have the baffle extend the same height as the tank, providing a six inch warm air duct

on top and a one foot cold air duct at the bottom.

A drip pan can be placed on the floor under the brine tank. Have it extend about three inches at each end of tank and about three inches or four inches at each side to catch the drip when the brine tank is defrosted. Pipe the drip pan to some point outside the box with ½ inch standard galvanized pipe.

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box."

GAUGE READING FOR HIGH ALTITUDE

QUESTION 270. I've been working on SO_2 and I am getting in on F-12 and methyl chloride. If I was using a set-up of gauges on a sulphur dioxide job, could I use these same gauges and short tubes on Freon and methyl chloride without cleaning the gauges and short tubing? It seems to me I must have three sets of gauges if one set must be cleaned before using on different refrigerant as too much time is lost cleaning out.

In the general run of household refrigeration, with a 75 degree F. room temperature, machine running, about what should the high-side pressure be, and at the suction side for each refrigerant—sulphur dioxide, Freon and methyl chloride?

This altitude is 3500 ft. and, of course, our compound gauge indicator should be set at 3-inch vacuum, whereas at sea level it is 0. For instance, if a certain refrigerator manufacturer at sea level called for 3-inch vacuum, then we put a pressure in the gauge to get 3-inch vacuum, and then if a 6-inch vacuum is called for, I suppose we just draw a 3-inch vacuum. For instance, a Norge at 100 degrees F. would have 70 lbs. highside pressure, a 6-inch vacuum, cut-in at 10 lbs. pressure. With compound gauge set to this altitude, would be 3-inch vacuum drawn at lowside. A Buckeye at 100 degrees F. would be 100 lbs. at highside pressure, a 3-inch vacuum, with compound gauge set to this. Am I right or wrong?

ANSWER: The ideal situation, of course, would be to use three sets of gauges, or one for each kind of gas. However, in actual practice this is not done, and the one set of gauges is used on all three gases.

I believe there is very little danger to be encountered in doing this since the slight possibility of mixing gases would not be worth considering. Of much more importance is the care to be taken in keeping dirt and moisture out of this equipment, and this can be done by capping the outlets when every service operation is completed.

The enclosed pressure-temperature relation chart, I believe, will answer your next two questions, at least in part. To correct the pressure-temperature relations through a correction of your gauge, which apparently is what you are trying to do, would be subject to considerable error, and may only be a source of confusing the proper procedure in this problem. As a matter of fact, pressures cannot be corrected directly from the gauge pressure at sea level, and since your gauge is a mechanical device, it cannot be corrected for the change in altitude. The only accurate means of making this correction is directly from the temperatures of the gas, which would be in the following manner:

Referring to tables, you will find the following data, which would be necessary to our problem:

1-inch mercury equals .419 lbs. per square inch.

1 lb. per square inch equals 2.0446 inches mercury.

Atmospheric pressure at sea level equals 14.7 lbs. per square inch.

Atmospheric pressure at 3500 ft. elevation equals 13.4 lbs. per square inch.

If the manufacturer specifies that the suction pressure of his refrigerator should be set for 0 lbs. gauge at sea level, by referring to tables, we find under SO_2, this will represent a temperature of 14 degrees F., or 14.7 lbs. absolute pressure. Converting this

to gauge pressure at your elevation, we find this will represent 14.7 — 13.4, which equals 1.3 lbs. per square inch. If the manufacturer recommends a 5-inch vacuum at sea level, again referring to tables, we find this represents a temperature for SO_2 of 6 degrees F., and 12.1 lbs. absolute pressure. Converting to your elevation, it would be 12.1 — 13.4, which equals — 1.3 lbs. pressure. Since 1 lb. per square inch equals 2.0446 inches of mercury, and your pressure gauge reads in inches of mercury, this quantity will then equal 1.3 × 2.0446 equals 2.6 inches of mercury.

From the foregoing, you will see that your calculations, in some cases, are in error, and that no degree of accuracy could be relied upon at any time with the method you suggest.

The accompanying table shows the pressures at both sea level and your elevation. A study of this, I believe, will clarify the whole matter.

On examining the wiring system, I found the heating element in the crankcase of the compressor was connected to the wiring circuit with only one wire going to the element, and which in my estimation was not connected correctly, as no current could pass through the heating element.

(1) Please let me know if the heating element that was inserted in the crankcase was connected properly, and if not, please let me know its proper connection in the wiring circuit.

(2) If I eliminated this heating unit, would its absence affect the running, or efficiency of the compressor?

(3) Has heating element enough resistance to be connected across a line voltage of 115 volts?

(4) If there is a knock in a compressor, can one tell if it is the pistons or crank without taking the compressor apart?

ANSWER: The heating element described by you in the Frigidaire compressor should

TABLE OF PRESSURES AT SEA LEVEL AND 3500 FEET ELEVATION

Absolute Pressure	Gauge Press. at Sea Level	Gauge Press. at 3500 ft. Elevation	SO_2 °F.	Methyl Chloride °F.	Freon °F.
4.9	20 in.	17.3 in.	—29		
7.4	15 in.	12.3 in.	—12		
9.8	10 in.	7.3 in.	— 2	—30	
12.1	5 in.	2.6 in.	6	—21	
14.7	0	1.4 lbs.	14	—11	—23
16.8	2 lbs.	3.4 lbs.	19	— 6	—20
18.9	4 lbs.	5.5 lbs.	24	0	—11
20.7	6 lbs.	7.3 lbs.	28	4	— 7
22.7	8 lbs.	9.3 lbs.	32	10	— 2
24.8	10 lbs.	11.4 lbs.	36	14	2
27.1	12 lbs.	13.7 lbs.	40	17	6
28.9	14 lbs.	15.5 lbs.	43	21	9
30.8	16 lbs.	17.4 lbs.	46	24	13
32.8	18 lbs.	19.4 lbs.	49	27	15
34.7	20 lbs.	21.3 lbs.	52	30	19
39.7	25 lbs.	26.3 lbs.	58	37	26
44.7	30 lbs.	31.3 lbs.	65	44	32
64.7	50 lbs.	51.3 lbs.	85	65	52
89.7	75 lbs.	76.3 lbs.	104	84	74
114.7	100 lbs.	101.3 lbs.	118	99	90
129.7	115 lbs.	116.3 lbs.	127	109	99
148.7	134 lbs.	135.3 lbs.	140	116	107

HEATING ELEMENT IN FRIGIDAIRE

QUESTION 271. **I was called to service a Frigidaire refrigerator (1931 using F-12) that was not operating. When I checked up, I found an opening in the wiring circuit.**

be connected in parallel with the motor circuit, or in other words, across the line so that 110 volts will pass through this heating element.

While the element may be removed, and perhaps would not cause any trouble during

Announcing

A NEW BABY

FEDDERS

Model 83

UNIT COOLERS

This new small size Model 83 follows the general design of the popular Series 73 line offering attractive cabinet design, quiet operation, permanently rustproof construction and high efficiency performance.

Included in their commercial refrigeration applications are small walk-in coolers, display cases, florists' refrigerators, dough retarding rooms and other similar installations.

ly quiet operation make them ideal for economical comfort cooling in modest-sized offices,

EAT TRANSFER SPECIALISTS

included in their commercial refrigeration applications are small walk-in coolers, display cases, florists' refrigerators, dough retarding rooms and other similar installations.

ly quiet operation make them ideal for economical comfort cooling in modest-sized offices, living rooms, stores and other places where economical and effective cooling is desired.

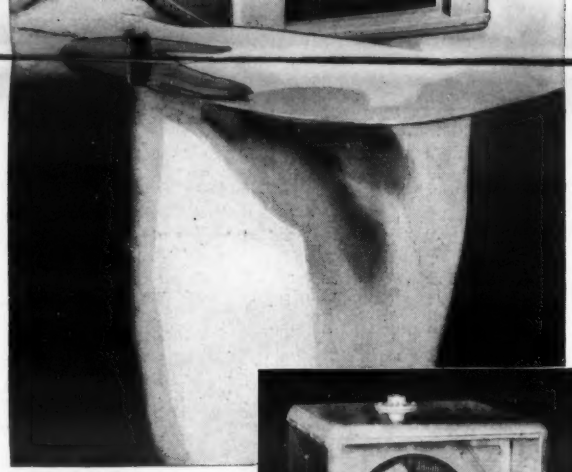
HEAT TRANSFER SPECIALISTS SINCE 1896

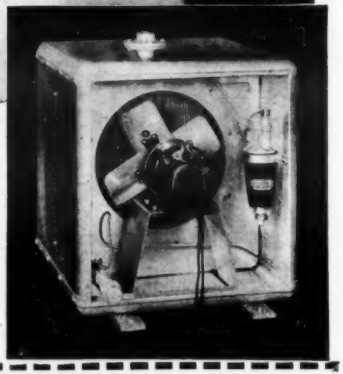
All-Copper Cooling Element has three rows of seamless copper tubing with inlets and outlets manifolded. Copper fins are arranged vertically for quick drainage of condensate.

Cabinets are insulated at bottom to eliminate accumulation of condensate on outside of cabinet. Hangers drilled for convenient ceiling or suspended mounting are standard equipment.

Louvers are available as extra equipment when specified.

The addition of Model 83 to the Series 73 line gives complete coverage for small as well as large installations ranging up to the high capacity of the Twin 73 Models.





Model 83 Unit Coolers are equipped with rubber mounted motors available in single and variable speed types. Fedders Model 33 Thermostatic Expansion Valves are standard equipment. Cabinet measures 14" wide x 14" deep x 15¾" high.

Write for Bulletin

FEDDERS

MANUFACTURING COMPANY

BUFFALO, N. Y.

Atlanta, 175 Luckie St., N. W.
Boston, 712 Beacon Street
Chicago, 112 N. Green St.
Cincinnati, 305 E. Sixth Street
Dallas, 209 S. Pearl Street
Detroit, 1036 Beaubien St.
Los Angeles, 1501 W. Eighth St.
New York, 114 E. 16th St.
Philadelphia, 2100 Arch Street

FEDDERS MANUFACTURING CO.
BUFFALO, N. Y.

Please send complete data on Model 83 Unit Coolers.

Name.....

Concern.....

Street.....

City.....RSE8

ARE YOU GETTING YOUR COPY OF THE FEDDERS NEWS?

mild weather, it will cause considerable trouble if the compressor happened to be subjected to cooler temperatures, such as during the winter time. Its purpose is to keep the Freon from condensing in the compressor crankcase, and thereby causing slugging of oil during the operating period of the machine. I don't believe it would be advisable to remove it.

While some claim the ability of being able to tell the cause of knocks in a compressor, I have yet to see the one who can prove it by actual practice. Personally, I do not believe there is any manner of distinguishing between these noises, or discovering the source of the trouble, without disassembling the compressor.

COMPRESSOR NOISE

QUESTION 272. I am servicing a Montgomery-Ward refrigerator employing a single-cylinder Universal Cooler compressor, with expansion valve and methyl chloride as the refrigerant.

The machine has a very noticeable click, which appears to be in the compressor, at each revolution of the crankshaft. I have tried to remedy this sound by installing a new discharge valve assembly and an extra thickness of gasket above the piston, without success.

This refrigerator is only about one year old, and had a new compressor installed about six months ago. The seal has also been repaired several times on the last compressor.

I would be very grateful if you could tell me what is the cause of the noise in the compressor. The pressures are all right.

ANSWER: Noises in compressors and faint clicking sounds are very hard to locate or determine their source. This is true of the man who is actually listening to them, and, of course, it is much more difficult for me to determine what it might be from your description.

However, I am inclined to think, from the description you have given me, and since the compressor is so new, that the noise is due to a side play in the piston pins.

The only way to overcome this, I believe, would be to install on each side of the connecting rod, a small spring washer such as the kind used for thrust washers in electric motors. These spring washers will act somewhat as a cushion, which will absorb the noise created by the side slap in the connecting rod.

CHANGING A COPELAND TO SO_2

QUESTION 273. I would like information in regard to a domestic Copeland No. 1, originally charged with Freezol. I am trying to get it to operate with SO_2 in place of Freezol, and I'm having an awful lot of trouble with a gummy substance that forms on shafts and bearings, and sticking compressor. According to information I got, it is due to moisture in the system. How am I going to get all this moisture out?

Here's what I did. Before any SO_2 was put into the system, I took the complete system apart—cooling coils, compressor, condenser, lines and receiver, and ran carbon tetrachloride through every part. The compressor, of course, was all taken apart, and washed with carbon tetrachloride, and a new charge of oil was put in. I assembled the system, keeping parts exposed as little as possible and plugging all connections immediately. I evacuated the system by running compressor, drawing a vacuum of 28 inches on system, and applying heat to entire system for two hours. Same was also tested for leaks and found okay.

I then began charging with SO_2, and everything seemed okay until the compressor was stopped. Then it became stuck and wouldn't start. I took the compressor apart and cleaned it again, and the same trouble happened again and again (three times). I took it apart and evacuated compressor for one and one-half to two hours, applying heat as explained each time. So I took the entire system apart again, and washed it out as before, and I'm still having the same trouble. New oil and different oil was used each time. What can I do to remedy this trouble, if possible?

The last time I started unit, I put some Warrenol in with compressor oil, but it still stuck with gum.

ANSWER: I can thoroughly sympathize with you in the difficulty you are having on the domestic Copeland charged with Isobutane. I think in tackling this job, you have tackled probably the most difficult conversion job in the field. I believe I can safely say that 75 percent of those who have tackled this type of conversion have had the same difficulty you are now experiencing.

Undoubtedly, the trouble is due to moisture, and apparently is so imbedded in the pores of the cast iron that it cannot be removed through ordinary drying means.

I believe the only possibility of overcoming your trouble would be to start again from scratch, thoroughly clean the machine

all the way through, changing all packing in the service valve, and then before charging with oil or gas, place the entire unit in a drying oven, and with a vacuum produced by another machine, keep the entire unit under about 200° F. for a period of ten to twelve hours.

Evidently these machines, due to the fact that Freezol was not affected by moisture, were never thoroughly baked in the drying oven, and you, therefore, will have to go through the same process as a manufacturing concern will do on the original drying of the unit.

This may not be as hard as it sounds if you haven't a drying oven in which to place it, since it is not so hard at times to build up a rough oven out of sheet metal, in which can be placed a hot plate to supply the heat. However, these are details which you will have to work out with the equipment you have.

The Typical Air Conditioning Job and the Service Man

By W. S. BODINUS *

THE place of the refrigeration and air conditioning Service Man is quickly taking a new and more important position in this business of cooling and conditioning. The great and rapid expansion of the comfort cooling branch of this industry during the last few years has given the public many poorly designed and inadequate systems of air conditioning installed by persons unfamiliar with the installation and service of this tailor made business. No two installations of refrigeration or air conditioning equipment are the same and even with the latest packaged arrangement for single refrigerators or for single air cooled rooms the Service Man must be the final and deciding factor in the satisfactory starting, adjusting and turning over equipment to an owner. The Service Man's job is no easy one, neither is it of insignificant importance since only by the use of his trained hands and complete knowledge of the business will we have a satisfied customer.

With special reference to the typical air conditioning job, we mean ones that at present are the most promising and the field in which most installations of air conditioning equipment are being installed. According to best authorities after a thorough analysis of the last season's business, the most fruitful field for air conditioning equipment is the commercial installation such as the beauty parlor, tavern, ladies' ready-to-wear shops, optical stores, doctors' offices, dental offices, restaurants and most every establishment serving the public. The tonnage of these installations ranges from about one ton to fifty or sixty tons and is the field which demands the most time of the air conditioning Service Man. Of course there are larger installations requiring specialized service such as department stores like Hudson's in Detroit, Macy's in New York, Mandel's in Chicago, The Fair and Marshall Field's in Oak Park all of which range from 300 tons to 6000 tons each and then, too, large hotels like the Palmer House with its 1000 ton single unit, and the La Salle; but all of these installations require the services of a corps of trained experts in many branches of work and these jobs fall into a special class rather than the typical air conditioning job. The typical air conditioning installation might be averaged as the job with a 10 or 15 ton refrigerating compressor in the machine room generally located in the basement with a weathermaker of same capacity located above, or in the sales space, or many times it is located adjacent to the compressor. The average selling price of the typical air conditioning job ranges between $2500.00 and $4500.00 and may require the services of a Service Man for periods of as little as two or three days or as great as ten days to two weeks depending upon the nature and difficulties of the installation.

In order to comprehend the many factors which affect the final layout installation, and purchase of the typical job, a brief description of the several steps will be made in this

* Engineer, Carrier Corporation. Reprinted from paper delivered at 4th Annual Convention R.S.E.S., Chicago.

Carrier

SURVEY FORM B-200 B

Prop. No. ..... Orig. Survey by ..... Date .....

Name of Job ..... Buyer .....

Address ..... Address .....

When Must Estimate be Completed? ..... When Must Install .....

P—ATTIC

Unvented? Gravity?
Vented? Fan?

.....

.....

Q—SMOKING or ODORS

No Smoking? No odors?
Smoking or odors?
Excessive smoking or odors?
Outside air change required?

.....

.....

R—REFRIGERATION

(If furnished by Buyer?)

Water? Press: .....
Brine? GPM: .....
Refrigerant: ..... Suct. Press: .....

.....

.....

S—REFRIGERANT PIPING

Can run where: .....

.....

Feet Line: ..... Ft. Insulated: .....

.....

.....

T—POWER CONNECTIONS

Volts: ..... Cycles: .....
Phase: ..... No. Wires: .....
Size or Capacity of

LIGHTS, PEOPLE, HEAT, ETC.	NAME OF SPACE OR FLOOR							
TIME SPACE IS OPEN	M to	M	M to	M	M to	M	M to	M
OUTSIDE CONDITIONS	DB	WB	DB	WB	DB	WB	DB	WB
INSIDE CONDITIONS—Summer	DB	WB	DB	WB	DB	WB	DB	WB
INSIDE CONDITIONS—Winter	DB	WB	DB	WB	DB	WB	DB	WB
LIGHTS—WATTS								
OTHER ELECTRICITY—WATTS								
WHEN IN USE—TIME								
PEOPLE								
Customers								
Employees								
Seats								
Concentrated?								
Active?								
Inactive?								
Type of work?								
Time of Peak (AM) (PM)								
Duration of Peak (Hrs.)								

HEAT (Restaurant Equip.)	Size	Heat	COMPLETE DATA RE OPERATING SCHEDULE
Urns			
Sq. Ft. Steam Tables			
Grilles			
Gas Burners			
Gas (Metered) Cu.ft/Hr.			
Kind Gas		Btu/Cu.F.	

HEAT (other)	Describe
Kitchen or Boiler Room Adjacent	
Unusual Sources	
MOISTURE (other than above)	

Present Panel Board:.....
Where is Present
Service avail:.....
Is new service required?
Where obtainable?.....
.....
.....

U—WATER CONNECTIONS

Service: City? Well?
River? Cooling Tower?
Where available: .....
.....
Size line:.....Press:.....Temp:.....
.....
.....

V—SEWER CONNECTIONS

Where available:.....
..... Size: .....
.....
.....

W—STEAM CONNECTIONS

Where available:.....
Size Supply:.....Press: .....
Size Return:.....Wet? Dry?
System: Vacuum? Vapor?
Gravity? One Pipe?
Two Pipe? Hot Water?
Boiler Size:.....Fuel:.....
Water Level:..... Firing:.....
Control:—Describe and consider how to co-ordinate with new equipment
.....
.....

WHO WILL DO FOLLOWING:	None	Buyer	Seller	Remarks
OPENINGS FOR getting in machinery, ducts, piping grilles				
PATCHING, Plastering and/or Redecoration				
SCAFFOLDING				
FOUNDATIONS platform, pad floor or ceiling reinforcing				
REMOVE obstructions to installation to air distribution				
REPLACE or relocate obstructions				
ENCLOSURES for apparatus				
PAINTING of (pipes) (ducts) (enclosures)				
CART from R.R. and/or LOCATE in place				
VENTILATION for Refrigeration Room				
EXHAUST SYSTEM for Kitchen or elsewhere				
REFRIGERATION PIPING run, insulate and connect				
ELECTRIC SERVICE from street and fused outlets within 50 feet				
WIRING for Controls Power				
CONDENSER WATER provide adequate source (and meter)				
PLUMBING for water lines sewer connections				
STEAM or other heating source of supply				
HEATING PIPING, run, insulate and connect				
DECORATIVE GRILLES (plaster, bronze, etc.) provide and install				

DETERMINE WHETHER	Yes	No	Remarks
STRAIGHT TIME without interference is possible for installations			
LABOR conditions require unusual provisions			
OPEN DOOR is required and if 2 or more doors on different sides, only 1 will be allowed open at one time.			
NOISE level critical			

.....Rev. Survey by.....Date.....Job No.....
.....Building Owner .....
.....Address .....
tion Start?.....When Completed? .....

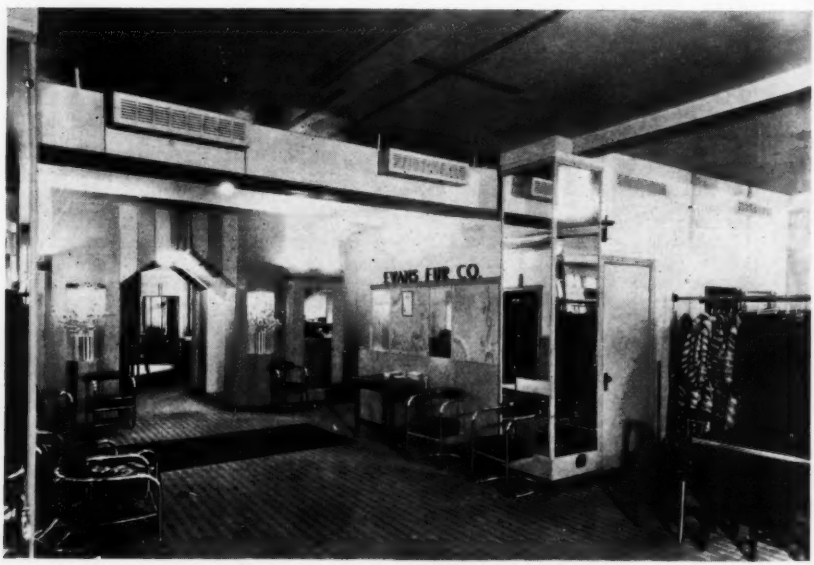
paper together with a few engineering principles for review by the Service Man.

The Owner

The reason for the typical air conditioning job is due to the evolution of conditions under which we live at the present time and it becomes a reality because the owner of an establishment must either install air conditioning equipment to attract the quantity and kind of trade which will cause his business to be more profitable, or he must install air conditioning equipment because competition is taking his business away from him. One or the other of these considerations or in some cases both are the direct cause of an owner's decision to invest his savings in the business of air conditioning. The cause of the original decision may seriously affect the final job of the Service Man since an aggressive merchant will usually purchase well planned equipment, from an established company at a price that will bring satisfaction to buyer as well as seller; whereas the merchant who is forced into purchase of air conditioning equipment by fear of competition very often has a financial problem or possibly has lingered so long that insufficient thought, time or money is provided to satisfy either buyer or seller. It is this kind of job that is heartbreaking to the Service Man because he must work with inadequate materials and equipment, limited time, and generally under pressure of necessity for immediate operation.

The Salesman

The decision having been made on the part of the owner, the next person in the game is the Sales Engineer representing the Dealer, Contractor, or Manufacturer, who makes the owner's acquaintance and obtains the necessary information for the air conditioning requirements. The Sales Engineer then prepares one of the most important documents of the air conditioning job, namely the survey. This should include a sketch of the conditioned space showing overall dimensions all major structural details such as columns, beams, stair openings, windows, etc. and a cross section giving heights, net ceiling height and clear height under beams. Windows should be spotted with sill height, window frame width and height; also space above window since these details establish locations for supply and return air duct. Large pipes, risers, as well as sprinklers, and ceiling electric outlets should be located and spotted on the plan. Total number of people, electric lights (approximate number burning), utilities such as toasters, steam tables, coffee urns, gas burners, and other appliances must be listed as well as noted on the plan since there are occasions when much of this equip-



THE TYPICAL AIR CONDITIONING JOB.

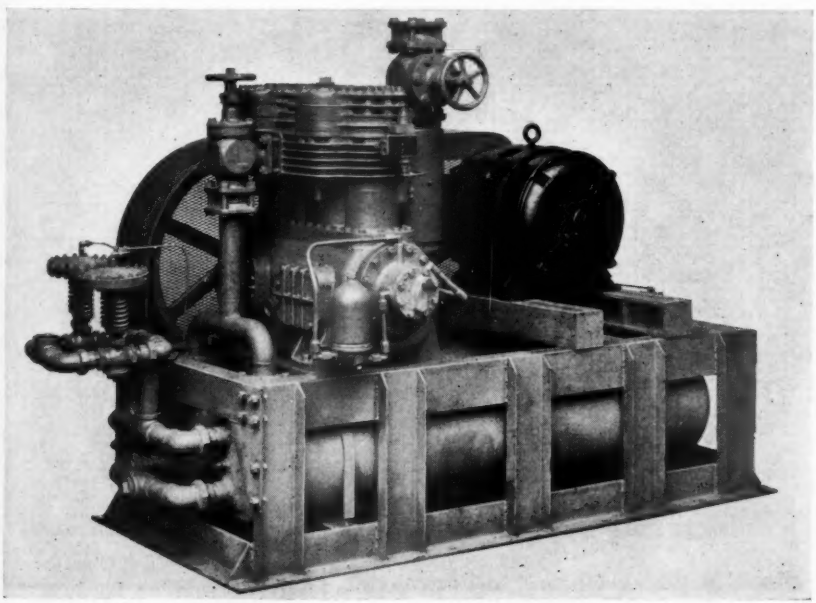
ment will be concentrated in one location thereby necessitating the supply of more air toward that particular location. Directions must be noted to provide a basis for determining the amount of infiltration as well as sun exposure. Tall adjoining buildings, shade trees, etc., should be observed and amount of shading noted. After all of the physical considerations have been made it is then advisable to approximate size of equipment and look for possible equipment locations. Air conditioning apparatus may be located within the air conditioned space, on the floor or at the ceiling, or may be immediately outside with duct and piping extensions to the space. Water cooling and refrigerating equipment should preferably be located outside the air conditioned space but as near to the air conditioning apparatus as possible to reduce initial cost and operating expense. If it is impossible to visualize the size of equipment, return trip is necessary after the heat estimate has been completed and the equipment selected. Most air conditioning dealers, contractors, or manufacturers provide their Sales Engineers with standard survey forms such as the one shown in the illustrations.

How often has the Service Man been sent to start a job only to find the condenser water connected to the hot water line or even to steam or gas pipes and the electrical current available 220 volt instead of 110 volt. The compressor located without heed to the noise problem or one of a dozen other headaches all of which can be traced back to the original survey.

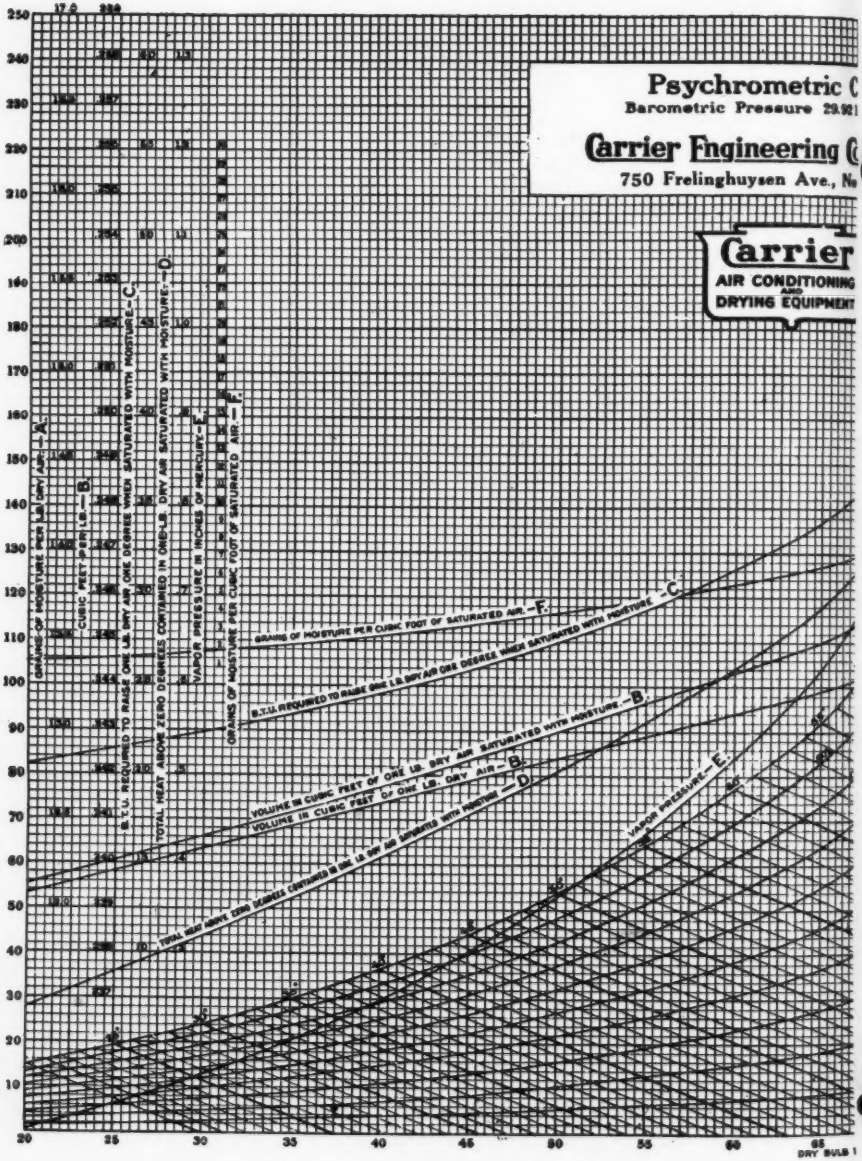
The Engineer

The survey with its information is turned over to the second party in the game—the Engineer who coordinates the data into a mathematical analysis of the air conditioning system. This air conditioning system which he designs is defined by the industry as the simultaneous control of the temperature, humidity, air purity and air circulation. The Service Man must be familiar with each of these four principles as well as to have a thorough knowledge of dry bulb temperatures, dew-point temperatures, wet bulb temperatures, relative humidity and other properties of air such as volume, pressure, weight etc. Briefly the definition of the most important are given as follows:

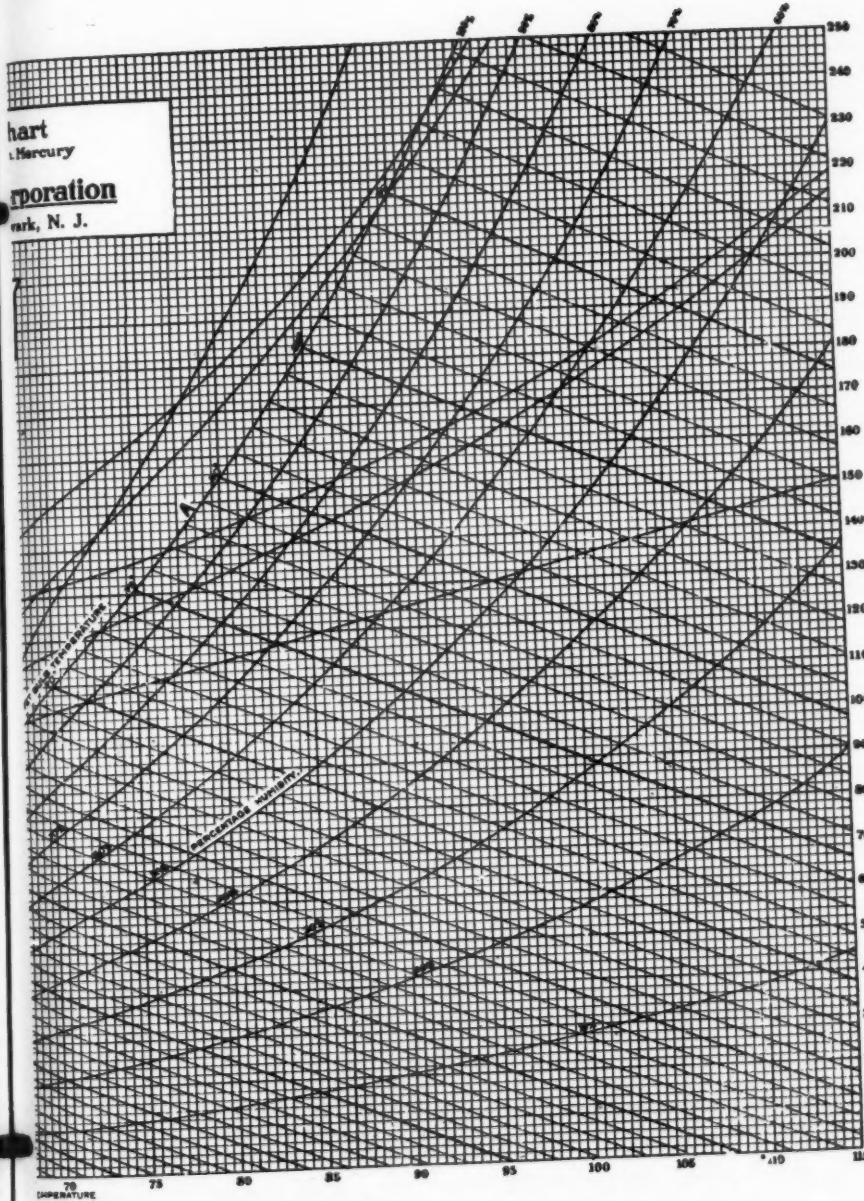
Dry Bulb Temperature is the temperature of the air as indicated on the ordinary thermometer. The dry bulb temperature also



REFRIGERATING MACHINE FOR TYPICAL JOB.


Psychrometric C
Barometric Pressure 29.92
Carrier Engineering C
750 Frelinghuysen Ave., Ne
Carrier
AIR CONDITIONING
AND
DRYING EQUIPMENT
GRAINS OF MOISTURE PER CUBIC FOOT OF SATURATED AIR—F.
B.T.U. REQUIRED TO RAISE ONE LB. DRY AIR ONE DEGREE WHEN SATURATED WITH MOISTURE—C.
VOLUME IN CUBIC FEET OF ONE LB. DRY AIR SATURATED WITH MOISTURE—B.
VOLUME IN CUBIC FEET OF ONE LB. DRY AIR—D.
VAPOR PRESSURE—E.
GRAINS OF MOISTURE PER LB. DRY AIR—A.
CUBIC FEET PER LB.—B.
B.T.U. REQUIRED TO RAISE ONE LB. DRY AIR ONE DEGREE WHEN SATURATED WITH MOISTURE—C.
TOTAL HEAT ABOVE ZERO DEGREES CONTAINED IN ONE LB. DRY AIR SATURATED WITH MOISTURE—G.
VAPOR PRESSURE IN INCHES OF MERCURY—E.
GRAINS OF MOISTURE PER CUBIC FOOT OF SATURATED AIR—F.
DRY BULB

(All references to temperatur



e are in degrees Fahrenheit)

gives a measurement of sensible heat in air.

Dew-point Temperature is the temperature at which dew forms in the atmosphere thus when atmospheric air is reduced in temperature, moisture (water vapor) will separate from the air in the form of mist or dew. When a cold glass of water is placed in ordinary atmosphere dew forms on the outside of the glass. Thus in an air conditioning apparatus one of the features of design is to provide a cooling surface of sufficient area as well as at a low enough temperature to precipitate the necessary amount of moisture.

The term *Relative Humidity* is used by many engineers in a careless way to mean "feeling or quality of dryness of the air" but as a matter of fact air with a relative humidity of 60 percent when the dry bulb is 40 degrees has less moisture than air with a relative humidity of 10 percent when the dry bulb is 100 degrees. Relative humidity is the relationship of water vapor in the air at the dew-point temperature to the amount that would be in the air if the air were saturated at the dry bulb.

Wet Bulb Temperature—The wet bulb temperature is the temperature read on an ordinary thermometer whose bulb has been covered with a wick that has been saturated with water. The evaporating effect of the water thus reduces the dry bulb temperature to the so-called wet bulb, which always falls between the dry bulb temperature and dew-point temperature. *The wet bulb temperature is the temperature at which adiabatic saturation* takes place; that is, the dry bulb temperature is reduced (sensible heat) and the dew-point temperature (latent heat) is increased, both meeting at the wet bulb. During this change there has been no addition or extraction of heat (adiabatic) since the dry bulb temperature is reduced at the expense of an increased dew-point temperature. This principle was originally pointed out by W. H. Carrier in A. S. M. E. transaction 1911. Mr. Carrier further established the fact that the wet bulb temperature represented a temperature which definitely indicated total heat of atmospheric air and values were tabulated and graphically plotted against the wet bulb on the Carrier Psychrometric Chart.

With IMPERIAL FITTINGS *the system remains tight!*

THE success of any refrigeration or air conditioning system is absolutely dependent upon tight connections.

Imperial fittings in both S.A.E. flared type and solder type have been especially designed for refrigeration work.

Nuts, tees, elbows and crosses are made from brass forgings and will not crack or split. They are heavier and stronger than the standard S.A.E. fittings and are non-porous, eliminating seepage and season cracking. Tees and elbows have flats for wrench hold. On fittings with female threads made from rod, Imperial uses an extruded bronze rod. This extruded bronze is not subject to season cracking. Imperial solder fittings are forged with the exception of couplings and return bends which are made from drawn seamless copper tube.

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IMPERIAL *Air Conditioning and Refrigeration Products*

VALVES • FITTINGS • TOOLS • CHARGING LINES • FLOATS • STRAINERS • DEHYDRATORS

The Service Man also must be sufficiently well versed with engineering principles to be able to translate the mathematical conclusions of the Engineer to actual working realities. This necessitates a study of the Psychrometric Chart as shown in the illustration with its accompanying examples.

The Carrier Psychrometric Chart, which is the original chart used for the analysis of air conditions is probably the most simple one to use and probably the best for the Service Man's kit. Thousands of typical air conditioning installations have been designed from it and in order to become familiar with its use the following examples and information are given. All references to temperature are in degrees Fahrenheit.

Dry Bulb Temperatures are represented by vertical lines with values indicated on lower edge of chart.

Wet Bulb Temperatures are represented by oblique lines with values indicated at their intersections with the curved line marked "Dew-Point or Saturation Temperatures."

Dew-Point Temperatures are represented by horizontal lines with values indicated at their intersections with the curved line marked "Dew-Point of Saturation Temperatures."

Percentages of Relative Humidity are represented by converging curved lines with values indicated thereon.

Any two of the above properties may be found if the other two are known. The following examples indicate the methods of using the chart. It should be noted that in the case of saturated air, the Dry Bulb, Wet Bulb and Dew-Point temperatures are identical.

Example 1

Given: Dry Bulb Temperature, 70 degrees; Wet Bulb Temperature, 60 degrees. Find the percentage of relative humidity and the dew-point.

Locate point of intersection of vertical line representing 70 degrees Dry Bulb Temperature with the oblique line representing 60 degrees Wet Bulb Temperature.

By interpolation this point indicates the

You pay little more for a gauge you can KEEP accurate

No one—not even Marsh—has ever been able to build a gauge that can't be knocked, kicked or banged out of adjustment. In this connection, however, there are two important differences between the Marsh Gauge and the ordinary kind:

(1) The Marsh Gauge will take a lot more punishment *before* it goes out of adjustment.

(2) The Marsh Gauge can be brought back to its original accuracy with the twist of a screw driver—and we mean *brought back.*

When a gauge is knocked out of adjustment in practically all cases the inaccuracy is caused by distortion of the bourdon tube. Resetting the pointer or moving the dial obviously won't correct this distortion, and therefore such methods won't correct the gauge for *all* points on the dial. The Marsh "Recalibrator" *will* correct it—will restore accuracy at all points—will actually *re-calibrate* the gauge. This feature is now available in all Marsh Gauges. You pay little more for this gauge that you can *keep* accurate than for any other quality gauge.

Write for catalog covering Marsh Refrigeration Instruments.

That's it—the RECALIBRATOR

JAS. P. MARSH CORPORATION
2059 Southport Avenue, Chicago, Ill.

MARSH Refrigeration Instruments
GAUGES—THERMOMETERS—RECORDERS—MERCURY SWITCHES

percentage of Relative Humidity as 56 percent and by following the intersecting horizontal line to the left to its intersection with Curve A the Dew-Point is indicated as 53.4 degrees.

Example 2

Given: Dry Bulb Temperature, 80 degrees; Relative Humidity, 59 percent. Find the dew-point and wet bulb temperature.

Locate the point of intersection of the vertical line representing 80 degrees. Dry Bulb Temperature with the interpolated position of the curved line which would represent 59 percent Relative Humidity.

Reading horizontally to the left from this point to Curve A the Dew-Point is indicated as 64 degrees and reading obliquely upward to the left, between the Wet Bulb lines, to Curve A, the Wet Bulb Temperature is indicated as 69.3 degrees.

Example 3

Given: Dry Bulb Temperature, 75 degrees! Dew-point Temperature, 55 degrees. Find percentage of Relative Humidity and Wet Bulb Temperature.

Locate the point of intersection of the vertical line representing 75 degrees Dry Bulb Temperature with the horizontal Dew-Point line intersecting Curve A at 55 degrees.

By interpolation, this point indicates the Relative Humidity as 50 percent and the Wet Bulb Temperature as 62.6 degrees.

Example 4

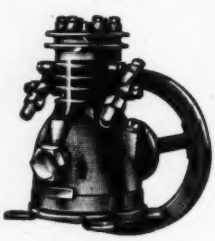
Given: Relative Humidity, 50 percent; Wet Bulb Temperature, 60 degrees. Find Dry Bulb Temperature and Dew-point.

Locate the point of intersection of the curved line representing 50 percent Relative Humidity with the oblique line representing 60 degrees Wet Bulb Temperature.

Reading vertically downward from this point to the Dry Bulb Temperature scale, the Dry Bulb temperature is indicated as 71.7 degrees, and, reading horizontally to the left to Curve A, the Dew-Point is indicated as 52 degrees.

To be Continued

In the September issue additional examples will be given in the use of the Carrier Psychrometric chart, together with the final steps in the installation of the Air Conditioning Job.



"Chieftain" Quality Built Compressors and Condensing Units

are designed to give you many years of quiet, efficient and trouble free service by Engineers who have been serving the refrigeration industry for the last fourteen years.

They have again "scored a hit" with a new "V" type four cylinder compressor which is designed for use with ½ to 1 HP motors. All of the advanced features that have proven so successful in "Chieftain" household and light commercial units are now incorporated in this new four cylinder model.

Mechanical improvements include, force feed lubrication to piston pin and connecting rod bearings, positive alignment of cylinder bores with main bearings by casting cylinders and crankcase in one piece. Adjustable suction shut-off valve, interchangeable parts with single and twin cylinder models. All compressor parts are machined to precision limits on up to date equipment and assembled in glass enclosed rooms where only filtered, dust free air is admitted.

Write for our latest descriptive catalog

TECUMSEH PRODUCTS CO., Refrigeration Division TECUMSEH, MICH.

NEW MECHANICAL DEVICES
Service Tools and Special Equipment

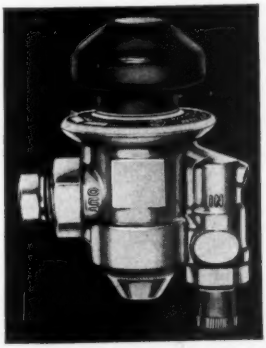
Under this heading there will be published illustrated descriptions of new or improved service tools and equipment for the Service Engineer. Information contained in this department is furnished by the manufacturer of the article described and is not to be construed as the opinion of the Editor.

AUTOMATIC PRODUCTS CO. ANNOUNCES NEW VALVES

THE Automatic Products Co., 2450 N. 32nd St., Milwaukee, Wis., announces the addition of two new valves to their line of refrigeration equipment.

The first of these is an automatic expansion valve, Model 204, the first of its type to be introduced to the A-P line. The second valve announced is the new Model 206 thermostatic valve. This differs from others of the A-P line in that it is a fixed superheat non-adjustable type.

While both of these valves are now making their initial bow to the general trade, they are not new. During the past two years, they have been under constant test in



A-P MODEL 204 AUTOMATIC VALVE

Snap-on

SPECIALIZED TOOLS FOR REFRIGERATION SERVICE

The *most* in wrench service . . . in the *least* space! There's room for Snap-on "combination wrenches" in every tool kit and once you use them you'll wonder how you ever worked without them. Eight long handles 7⅝" to 12"—and each is two wrenches in one, boxocket and open end. Boxockets grip like a socket wrench; open ends turn nuts fast when work is in the open.

Also built with short handles—5⅛" to 6 15/16". Openings ⅜" to 1".

Available only through our own branch distributing warehouses located in 37 principal cities. See Snap-on Tools Corporation in your telephone directory or send coupon.

SNAP-ON TOOLS CORPORATION
Kenosha, Wisconsin

☐ FREE special literature on refrigeration tools; also 160-page catalog.

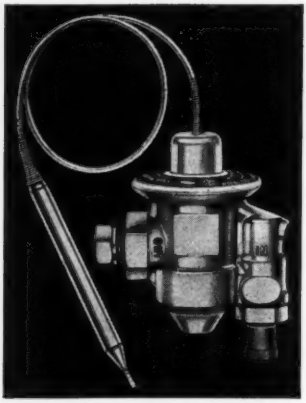
☐ Show me combination wrench set.

Name .....

Address RSE-8

the A-P laboratory, and in use by several leading manufacturers. These concerns are now demanding production.

In the 204 automatic valve, fine accurate adjustment has been provided for, permitting accurate adjustment of the valve to the system. It has an adjustable range from 20 inches vacuum to 30 lbs. pressure. It has a rating of ¼-ton with Freon and ½-ton with methyl chloride or sulphur dioxide.



A-P MODEL 206 THERMOSTATIC EXPANSION VALVE

The Model 206 thermal valve is very similar in design to the Model 204, with the addition of a thermostatic bulb. It is furnished in two orifice sizes, giving a ¼-ton capacity with Freon and ⅓-ton with methyl chloride or sulphur dioxide. Its small compact design and ⅜-inch bulb make it desirable in those installations where space is a factor.

Write for Bulletins 407-A and 407-B for complete information.

NEW HIGH-LOW PRESSURE TEMPERATURE CHART FOR THE REFRIGERATION SERVICE ENGINEER

A HIGH-LOW Pressure Temperature Chart, recently announced by R. W. Cook, Box 176, Columbus, Ohio, has been designed to show the head pressure for any low side pressure and any room temperature, for all air cooled installations using sulphur dioxide (SO_2), methyl chloride or Freon (F-12).

This handy chart consists of two heavy celluloid discs, riveted together in the cen-

PEERLESS MODEL V

THE THERMAL EXPANSION VALVE THAT IS EASY TO ADJUST

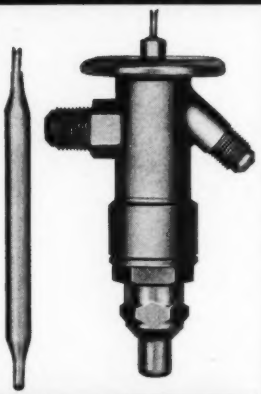
HALF THE TIME

TWICE AS ACCURATE

If you've often wished for a thermal valve that could be adjusted quickly, easily and accurately, your wish is granted. The new Peerless Model V is just such a valve.

A large spring with a minimum pressure build-up plus a fine thread on the adjusting screw result in only 1° superheat change per turn of the screw, practically a micrometer adjustment.

Use only Peerless Model V Valves—save time and stop useless service calls.



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THE "VELVET ACTION" VALVE

BUY PEERLESS FOR PERFORMANCE

THE NEW PRESSURE-TEMPERATURE SLIDING CHART

ter so that both discs may rotate independently. The larger disc is only three inches in diameter, small and compact so that it can be carried in the shirt pocket.

This chart was especially designed for the refrigeration service engineer to enable him to determine instantly from his suction gauge reading and his room temperature reading, what the head pressure should be. With the information that this chart contains, a service man can check an installation and instantly tell if there is trouble due to too much liquid, dirty condenser, air in the system, compressor inefficiency, etc. Up to this time, the service man has had little help from his head pressure gauge, in the majority of cases, in diagnosing these troubles. This chart gives the answer to the service engineer's most frequent question, "Is the head pressure right?"

S S S

W. E. Whelan
California

Enclosed is a $2.00 money order to renew my subscription for THE REFRIGERATION SERVICE ENGINEER publication. In the past, I have found this magazine very educational and useful in my work, and hope to be able to continue using it for some time.

S S S

FRIGIDAIRE PORTABLE CONDITIONING UNIT

A COMPLETELY new type of unit air conditioner for residential, office, hotel, hospital and similar uses, which embodies the famous meter-miser mechanical prin-

FOR COMMERCIAL USE

Mills Compressors

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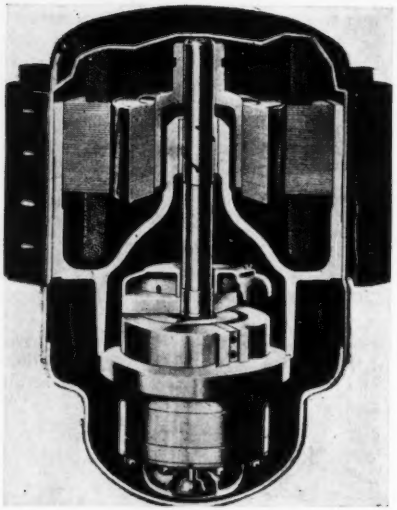


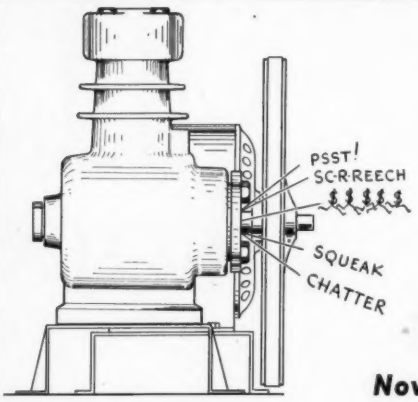
THE METER-MISER REFRIGERATING UNIT
Showing the twin rotor compressor driven by a ¾ h.p. motor

ciple that revolutionized the refrigeration industry, was announced recently by General Motors' Delco-Frigidaire Conditioning Division.

The new room conditioner is the first air conditioning equipment to incorporate the hermetically-sealed, long-life, low-operating cost meter-miser.

As advanced in design as it is in mechanical principle, the new unit looks much like a console radio cabinet of extraordinarily compact size. It has finger-tip dial control, and cools, dehumidifies, cleans, circulates the air and provides year 'round ventilation. It is portable and requires no plumbing and no electrical or other installation work except the connecting of the power circuit and the fitting of an adjustable window section. It will market for $999.50 completely installed. A five-year protection policy, the same type now covering Frigidaire electric refrigerators, is provided purchasers.

The unit has a maximum cooling capacity equivalent to the use of 1,300 pounds of ice in a twenty-four hour period. The circulation of air through the filters cleans it of dust, dirt and pollen, a service that will be of benefit to many sufferers from hay fever.



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SHAFT SEALS
Now Available for Practically All Makes of Compressors.
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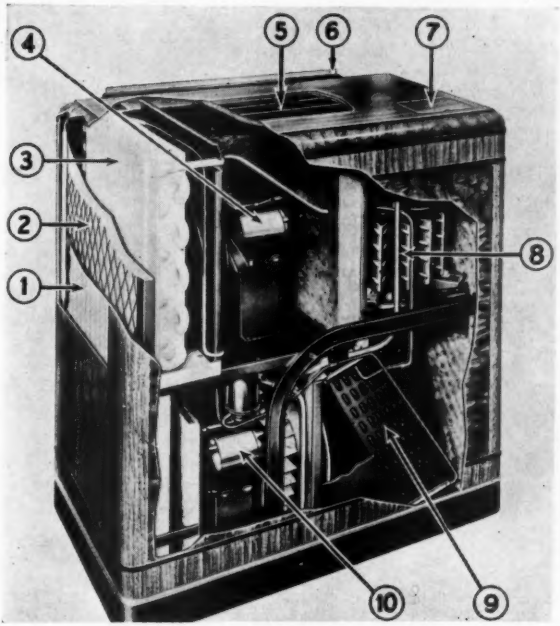
1. Room air intake grille
2. Filter
3. Cooling and dehumidifying coil (evaporator)
4. Room air circulating fan and motor
5. Conditioned air outlet grille to room
6. Window duct connecting to outside
7. Concealed comfort control panel
8. Sealed meter-miser refrigerating unit
9. Refrigerant condenser coil
10. Fan and motor for air cooling condenser



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NOVEMBER 2 • 3 • 4

ASS'N HEADQUARTERS

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NIAGARA FRONTIER CHAPTER
The REFRIGERATION SERVICE ENGINEERS SOCIETY

invites every Service Engineer to Buffalo

EDUCATIONAL

Your Society representing *your* interests invites you to Buffalo to participate in the "better than ever" 5th Annual Convention. Of course all members are expected, but if you are not a member—consider this your cordial invitation to be on hand too! You will profit in many ways.

Educationally speaking—the convention program is being arranged to be *informative*—you will hear a practical three day educational conference by the men who "make the wheels go around." It will be arranged to inform and answer *your* problems.

The manufacturers exhibit will be a display of the latest developments in equipment you use daily in your business.

Make your plans now to attend the refrigeration service engineers own convention.

ENTERTAINMENT

Niagara Frontier Chapter and Buffalo look forward to being your hosts. Many famous points of interest await you. Foremost, of course, among the many attractions is Niagara Falls. See them from both the American and Canadian sides.

The entertainment committee is arranging to make your visit to Buffalo a memorable one. A full schedule of events will keep you happily occupied.

Be in Buffalo, sure—November 2-4.

BRING THE LADIES

By all means the ladies are expected. They will be entertained and feted—not an idle moment will be theirs. You will be with us—won't you?

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POSITIVE CONTROL LIQUID COOLERS

COLTROL D-X *(Left)* a dry-type instantaneous cooler, and COLTROL *(Right)* a brine-type cooler. Both types give you perfect temperature control and perfect foam control. Either fits standard beer coil box. All refrigerants. Permits steam or chemical cleaning of beer coils. A source of quick profits for you. See your Jobber or write direct.

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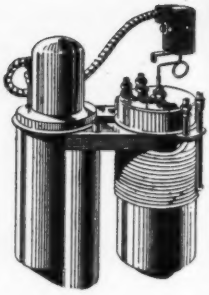

F. V. GOLITZ, secretary of Pittsburgh Chapter, is perhaps contemplating another line of business because, while in Butler, he acquired an electric beer sign and a set of scales. We haven't heard from him lately regarding an opening, though.

Wm. F. Kirby
Connecticut

I am a new subscriber to your very worthwhile publication, and certainly should have subscribed long before now. It certainly does contain a wealth of information.

ELECTRIMATIC WATER REGULATORS

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FOR
FREON-METHYL-SULPHUR

FURNISHED IN ⅜" IPS FOR COMMERCIAL REFRIGERATION OR AIR CONDITIONING CONDENSING UNITS

BRONZE BODY
REPLACEABLE VALVE SEAT AND SEAT DISC

WRITE FOR CATALOGUE

THE ELECTRIMATIC CORP.
2100 Indiana Ave., CHICAGO, ILL.

Chapter Notes

Under this heading will appear news of the chapter meetings. For names of the officers and dates of regular meeting nights, please refer to the Chapter Directory.

PITTSBURGH CHAPTER

July 8th—The regular meeting of the chapter was held at the Wagener Refrigeration Service Company in Butler, Pennsylvania.

Due to the scheduled tour, all business was postponed until the next meeting.

With Mr. N. D. Wagener as a guide, the party inspected a candy cooling system at the Butler Specialty Company. The next stop was the Wagener installation at the Herold Dairy Store. Also, in the same building, the 125-hp. carbon dioxide cooling system at the Warner Theatre.

This tour was the best of the season from the standpoint of interest and fine workmanship. The thanks of the chapter were extended to Mr. Wagener for arranging the tour.

MADISON CHAPTER

June 7th—The Question Box was an interesting feature which started the educational

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Automatic Expansion Valves (All Makes)	$1.25
Thermostatic Expansion Valves	3.00
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Pressure-tested to prevent leaks; dehydrated and sealed to avoid condensation, you can be sure with REMPE.

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program of this meeting. Mr. Larson then introduced Mr. L. McKesson of the Ansul Chemical Company, who produced a movie on refrigerants and refrigerant driers. The movie and Mr. McKesson's explanation were very much enjoyed by the entire chapter.

Mr. Herman Goldberg of Chicago, also representing the Ansul Chemical Company, followed with a short talk which was greatly enjoyed.

June 28th—After some discussion at this meeting, it was duly moved, seconded and passed that an educational school be started in the chapter using as a basis the Lecture Course sent out by the National Society.

Mr. Larson then introduced Mr. Herman Goldberg of Chicago, representing the Ranco company. He showed movies of the Ranco plant and the construction of their controls. He also showed short movies of Chicago Chapter doings and other interesting topics. Sample controls were passed around for inspection by the members present. Innumerable questions were asked, and were answered by Mr. Goldberg.

July 26th—On the educational program of the evening, Mr. Larson introduced Mr. Banks of the Minneapolis-Honeywell Regulator Company, who proceeded to prove his point: that it is possible to have a complete defrost cycle of a cooler with temperatures above freezing and thereby increase the capacity of the installation to the complete satisfaction of the customer. The new Polatron system is the means of doing this and will produce such results even though the job may be slightly undersized.

Refreshments followed this educational program with a general informal get-together.

WICHITA CHAPTER

July 15th—Holding their meeting in the usual meeting place of the Kansas Gas and Electric Company, Wichita Chapter proceeded with a short business session, after which an informal discussion of questions and answers as published in the Official Organ created a new educational feature, which apparently was enjoyed by all.

ST. LOUIS CHAPTER

July 14th—Some discussion was held on the forthcoming picnic to be held on or about August 21st. President L. L. Vollman was appointed Chairman of the Committee, with Messrs. Haney and Steinkamp

Take All Wheel Gear Puller

A midget with the pull of an elephant. Every serviceman and shop needs one. High grade steel. Sturdy, compact, light weight (2 lbs.). Meets practically all requirements, where a puller is used. Changeable from three to two arm puller, almost instantly.

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FLUSHING REFRIGERATION CO.

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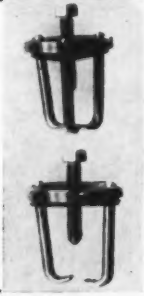

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When a customer's cooler doesn't work right—when dead air spots and freezing zones impair foods and humidity is too high or low—it's time to show him Action-Air System—the correct air circulation in coolers. Sells itself on a demonstration. Pays for itself out of savings. Makes good profit for you—adds new customers — leads to repeat business. Used in wide variety of applications since 1932. Write for our attractive proposition today. The Brown Corp., 617 Bellevue Ave., Syracuse, N. Y.

ACTION-AIR SYSTEM

as the Grounds Committee; Mr. E. Fix, the Jobber Contact Committee, and Mr. O. Petri in charge of arrangements at the grounds.

At this meeting it was decided that no regular meetings will be held until September 23d.

The educational program followed, with a film on the Frigidaire thermostatic expansion valve.

Refreshments concluded the events for the evening.

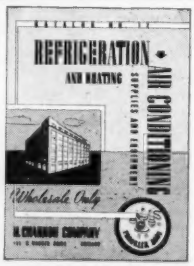
TRI-COUNTY CHAPTER

June 17th—The first announcement of the evening was of a forthcoming tube bending contest to be held early in the fall. Plans call for inviting Rockford Chapter to participate in this event.

There being no scheduled educational program for the evening, a general discussion was started and members were requested to write questions on paper that was handed to them and to place them in the Question Box. These questions were then thoroughly discussed and answered to the satisfaction of the writer.

As an added attraction and through the courtesy of the Automatic Heating and Cooling Supply Company, a refrigerant guessing contest was held and was won by George Monferdini of Joliet.

This contest was conducted as follows: When the members entered the meeting room they were handed a slip of paper and told to "weigh" the three drums of refrigerant which had been placed in front of the room. We all know how adept service men are in guessing the amount of gas in a drum.



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AMMONIA
METHYL CHLORIDE
SULPHUR DIOXID

Servicemen often miscalculate gas concentrations. Judging by the way their throats feel after a few whiffs, even old timers start their estimates at 10%!

The truth is a 5/100th. of 1% concentration of SO_2, or a 3/10ths. of 1% concentration of NH_3, is unsupportable; and dangerous. So what? This Fume Kit removes the hazard. Comes equipped with cartridges for Ammonia, Methyl Chloride and Sulphur Dioxide. It is light, durable, comfortable; also, inexpensive. Write for details and prices today.

CESCO Healthguard FUME KIT

CHICAGO EYE SHIELD CO., 2341 Warren Blvd., Chicago, Ill.

This was found to hold true with many of the members. Some guesses were for the exact amount. Mr. George Monferdini of Joliet, who won the contest, was only four ounces off on the total weight of the three refrigerants.

This contest created a lively interest at the meeting, and others are planned for coming meetings.

MISSISSIPPI VALLEY CHAPTER

July 8th—Announcement was made of the Illinois State Association Convention which is being planned for Saturday and Sunday, October 1st and 2nd, to be held in Springfield, Illinois.

President J. L. Fish then talked to the members regarding a price schedule on different types of work in the refrigeration line and after some discussion it was decided that sixty sets of price schedules should be mimeographed and placed in the hands of the members.

MEMPHIS CHAPTER

June 1st—At the invitation of the National Association of Practical Refrigerating Engineers, the Memphis Chapter of the R.S.E.S. met with the N.A.P.R.E., during which meeting a very interesting educational program was enjoyed by all. Messrs. A. B. Schellenberg and George Roepke of the Alco Valve Company presented interesting talks and demonstrations of the Alco glass evaporator. Memphis Chapter appreciated this opportunity of joining with the N.A.P.-R.E. for such an enjoyable evening and looks forward to more such events.

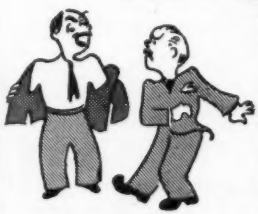
KANSAS CITY CHAPTER

June 28th—President T. L. Anderson opened the meeting with a short talk on the membership drive which is now in force, asking the cooperation of all members present to make this drive a success. He stated there were quite a number of new men in the field at the present time who are eligible for membership, and it is the desire of the chapter to bring these men in.

It was announced that at the close of the contest the losing team will entertain the winning team.

Complimentary remarks were made on the

Don't fight boys; it's all settled,



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CHICAGO
WRITE TODAY for NEW CATALOG

new Ranco manual which was reviewed during the meeting and it was suggested that the Educational Committee try to secure similar literature from various manufacturers.

On the educational program of the evening, Mr. von Demfange gave a short talk on the Grunow thermene gas refrigerator, explaining its principle and operation.

DAYTON CHAPTER

June 24th—At this meeting Mr. T. C. Bickel gave a short talk on the birth and history of the Society for the benefit of those visitors present.

The meeting was then turned over to the Chairman of the Educational Committee, Mr. H. Shoupp, who conducted the educational program of the evening.

July 8th—Announcement was made that the next meeting would be held in the offices of Mr. W. R. Scherer at 674 S. Main St., Dayton.

After the regular business session and usual reports of committees, the meeting was turned over to the Educational Committee for the balance of the meeting.

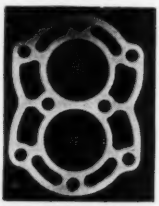
July 22nd—The educational program of this meeting consisted of a talk by Mr. R. V. Clark, branch manager of the Penn Electric Switch Company of Goshen, Indiana. Mr. Clark gave a demonstration of Penn switches in operation, using a demonstration display board operated by a small compressor. This demonstration proved to be very educational and was much enjoyed by all present.

* * *

FRONT COVER

ON the front cover of this issue is a view of an installation of Mills condensing units, made by Wagener Service, in an ice cream dispensing establishment in the town of Butler, Pa.

The units used in this installation are of the four-cylinder, three-horsepower, air-cooled type. The fixtures connected to them are as follows:

REPLACEMENT GASKETS FOR ALL MAKES
Metallic Gaskets that hold regardless of what the refrigerant may be and will not shed particles of material to clog up important working parts in a machine.
Send for catalog listing many "orphans" not available elsewhere.

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This handy chart instantly shows the HEAD pressure—for *any* suction pressure at *any* room temperature for all air cooled installations using Sulphur Dioxide SO_2, Methyl Chloride or Freon F-12. Don't guess about head pressures — secure this chart immediately. Price $1.25. Send Check or Money Order.

R. W. Cook, Box 176, Columbus, Ohio

Left Hand Compressor

1—100 gal. dispensing cabinet at 8 to 10 degrees F.
1—40 gal. dispensing cabinet at 6 to 8 degrees F.
1—20 gal. dispensing cabinet at 12 to 14 degrees F.
1—6 ft. ice cream display case —6 to —2 degrees F.

Provisions are also made for the addition of a 225-gallon ice cream storage box to be added to this unit.

Right Hand Compressor

1—6 ft. McCray delicatessen case
1—5 x8 walk-in cooler
1—Soda fountain, containing four draft arms and 20 sirup jars
4—Milk compartments, with two milk pumps each

No controls other than the thermal expansion valves and the pressure switches on the units are used for the control of the systems. Proper temperatures, however, are obtained, which indicates a nicely balanced condition.

Over 1,800 feet of copper tubing were required in the installation. Liquid lines are all ⅜-inch tubing, while the suction lines are ⅝-inch for the first 40 feet, reduced to ½-inch for the balance of the run. The longest run is 85 feet.

All joints and connections are made with streamline fittings, and out of 128 joints made, only one leak was found during the test after installation. Freon is the refrigerant used.

The store is of the latest, most modern design. All fixtures are located in the center, giving an island effect, and permitting customer access to all sides.

A large volume of business is enjoyed by the establishment, as may be judged by the fact that 1300 banana splits were sold in one day.

The refrigerating equipment has proven to be amply powered, with a minimum operating cost, and in general, is very satisfactory.

Mr. Wagener, as you may know, is Chairman of the Educational Board of the Pittsburgh Chapter.

HERMETIC REBUILDING SERVICE

G.E.—Westinghouse and Majestic

Customers in 37 states had hermetically sealed units rebuilt or exchanged by us in the past year. Complete factory equipment for precision rebuilding. One year guarantee on all rebuilt units. Exchange service available on most makes and models. Write for prices and descriptive literature.

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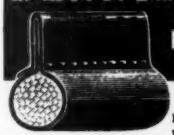
FOR ALL MAKES
REFRIGERATOR
DOORS



A complete line of rubber - coated, packed Gaskets and extruded rubber Gaskets that last longer —retain higher efficiency—because made of finest materials and workmanship. Write for free samples, giving your jobber's name and address.

W. J. DENNIS & CO.
2110-20 WEST LAKE ST. ··· CHICAGO

THE E. Vernon Black family, of Uniontown, Pa., is recovering, growing and doing fine!

Vernon is recovering from a serious operation, which kept him in the Uniontown Hospital for four weeks. While he was confined there, Mrs. Black presented him with a future serviceman.

The latest reports are that all are home and coming along fine.

Vernon is able to take a few service calls, but his understudy has not been called out yet.

S S S

R. J. CLEMENTS PROMOTED

CONGRATULATIONS are in order for Mr. R. J. Clements who has recently been promoted to the position of product manager for Gould-Farmer, Inc., General Electric distributors in New York.

Mr. Clements started in the refrigeration industry twelve years ago in 1926, with the Frigidaire Corporation, becoming connected later with Delco Light Company. Four years ago he started work for Gould-Farmer, Inc., where he held the position of assistant service manager until his recent promotion.

Mr. Clements was one of the founders of the Central New York Chapter of the R.S.E.S. at Syracuse, where he became a charter member. Since his new position requires his residence to be in Rochester, New York, the Syracuse members are regretting their loss. It is to be hoped, however, that Mr. Clements will again become an instigator in the formation of a chapter, this time in Rochester. In the meantime we wish him every success in his new position.

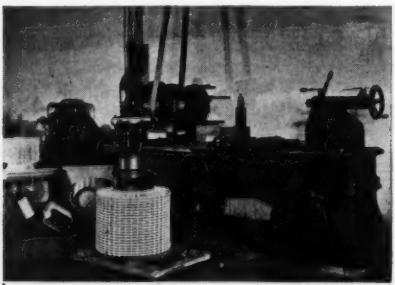
S S S

NEW CATALOGS AND BULLETINS

THE HARRY ALTER CO., Chicago, Ill., announces their new Catalog No. 124 for July and August. With the issuing of this edition, The Harry Alter Co. is celebrating their fifth anniversary of service to the refrigeration industry.

Contained in this new 128-page book is a complete line of genuine Grunow replacement parts and supplies of the latest type and design.

Your copy may be obtained from your nearest branch office, or by writing the company at 1728 S. Michigan Ave., Chicago, Ill.



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Complete Rebuilding and Repairs on All Models
Specializing on Westinghouse, G. E. Monitor Tops and Majestics
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describes the training and tells how others have profited. Write for it today.

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MILLS NOVELTY CO. ISSUES "DIPLOMA OF MERIT"

THE first "Diploma of Merit" was recently issued to Mr. S. A. Leitner, of the Leitner Refrigeration Service, Kansas City, Mo., for the efficient handling of 50 freezer installations, which, in the opinion of Mills, were made service-proof by careful installation and proper customer instruction.

LEFT—S. A. LEITNER. RIGHT—W. D. AMBROSE

Mr. Leitner is well-known through his work in the Refrigeration Service Engineers Society, where he is serving his third consecutive term in the office of National Treasurer.

Mr. W. D. Ambrose, service manager for Mills Novelty, presented the diploma. Mr. Ambrose has over 450 independent service organizations throughout the country under contract to service Mills equipment, and has performed an outstanding job of guiding this large group. He is known from coast to coast for the interest and help so freely given the independent service engineer.

* * *

NEW ESTIMATING SHEET OFFERED AS AID IN AIR CONDITIONING

COMPLETE well arranged estimating sheets for figuring cooling and heating loads for air conditioning are available as a Fedders service to the industry.

These sheets cover the essential points necessary for specifying the correct equipment to meet specific conditions. They are well arranged to simplify figuring and all

Jarrow Replacement Door Gaskets

The gasket illustrated was made especially for GENERAL ELECTRIC replacement. It fits. All JARROW gaskets are built to Manufacturers' original specifications. Insist on JARROW GASKETS.

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made by any refrigeration equipment manufacturer on our list is in stock on our shelves ready for immediate shipment. We handle many lines in Canada on an exclusive basis.

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A complete set of thin-walled sockets designed especially for refrigeration service with Refrigerator Ratchet Wrench, Adapter Plug, 4½" Slide Tee Handle, Extension Bars and three short refrigeration box wrenches in compact case.

All tools are of S.A.E. Chrome Vanadium or Special Alloy Steel, electrically heat treated and triple chromium plated.

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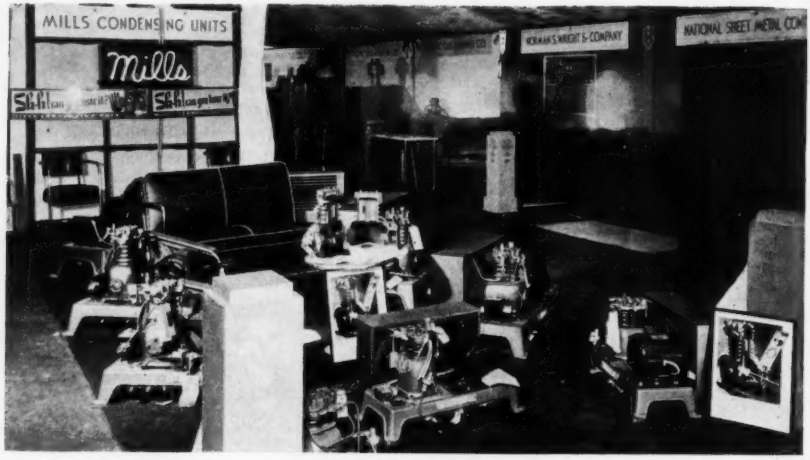

MILLS EXHIBIT AT THE LOS ANGELES AIR CONDITIONING SHOW

A view of Mills Novelty Company's Exhibit at the Los Angeles Air Conditioning Show held July 7. W. W. Allison, Mills distributor on the Pacific Coast, and Mills district manager C. J. Lyall combined their efforts to put Mills' part in the Show over.

In the background is a large white sign which reads Mills. This appears to be rough script lettering, but actually it is made of copper tubing refrigerated with a Mills condensing unit.

Refrigerating Engineers Appreciate the Accuracy of ALCO "TK" Thermo Valves

THE success and acceptance of the new Alco low cost, small capacity "TK" Thermo Valve is due to the famous Alco record of accurate control. The "TK," like other Alco Thermo Valves, restricts the line of complete evaporation to the narrowest limits—assuring highest evaporator efficiency at all times.

Since their inception, no "TK" valve has ever lost its charge — additional proof of the dependable, trouble-free service characteristic of every Alco refrigerant control. Yet the "TK" is offered at a saving of 20 to 40% in cost over previous Alco small capacity valves. It will pay you to get full details and specifications of Alco's line of "TK" Thermo Valves. See your jobber today.

ALCO VALVE COMPANY, INC.
2630 Big Bend Blvd.
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ALCO

Engineered Refrigerant Controls for Highest Evaporator Efficiency

the essential data is on a letterhead sized sheet.

They are an aid in selecting "All Season" air conditioning units as well as heating and cooling coils. These sheets are available upon request by writing to Fedders Manufacturing Company, Buffalo, or any of the nine Fedders branches.

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One hundred representative jobbers handling Fedders refrigeration products have been supplied with an effective Valve Merchandiser which adds actual demonstration to display.

The demonstration feature consists of a Fedders Model 33 Thermostatic Expansion

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Parts for Grunow and Majestic. SEND FOR CATALOGS. Dealers wanted. G & G GENUINE MAJESTIC REFRIGERATOR & RADIO PARTS SERVICE.

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Valve mounted on the board with pressure gauge, filter and hand operated shut-off valve connected to a small tank of methyl chloride mounted on the rear of board.

The feeler bulb is lined up with the outlet of the thermostatic valve so that when the refrigerant is turned on by opening the shut-off valve, the refrigerant flows through the thermostatic valve and strikes the bulb. This immediately causes the

FEDDERS DISPLAY BOARD

power element to function, thus closing the valve and shutting off the flow.

As soon as the bulb warms up the valve opens and the cycle is repeated.

The board also carries a display which includes the Fedders constant pressure valve, automatic expansion valve and check valve.

Jobbers are using the Valve Merchandising boards as central demonstration and display units in their showrooms, and are finding them effective in focusing attention on the product and its performance.

The displays were tried out by Marc Shantz, in the territory served by the Chicago factory branch, and as a result of their effectiveness and acceptance by the trade they have been made available to jobbers from coast to coast.

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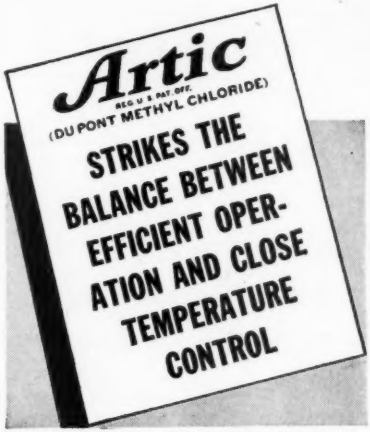
Rate: One Dollar for thirty words or less. 20 cents for each additional ten words or less.

FOR SALE—BARGAIN—Factory rebuilt high-sides, ½ to 5-horsepower. Write for prices and details. All Makes Refrigeration Sales & Service, Inc., Fred Roth, president, 2407 Montrose Ave., Chicago, Ill.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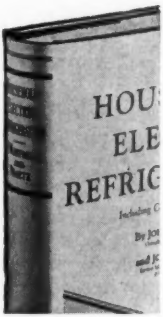
How to install, service, and repair all types of household refrigerators.

This book presents everything needed by the man who is servicing electric refrigerators, from a simple explanation of how they work to detailed, practical methods and data on installation, testing, servicing, adjusting, trouble-shooting, repairing, etc.



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Including Gas Absorption System

By Wostrel and Praetz

406 pages, illustrated, $4.00

A practical manual for installation and refrigeration service men, giving descriptions and illustrations of many popular makes of machines, showing both the entire system and details of parts, and emphasizing the basic points of construction and operation. Besides the step-by-step descriptive material, numerous charts and tables giving reference information in handy form make this a practical book.

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"Yes!" shouts the industry with an avalanche of orders. Today every man in the field should know that a dryer that does not hiss is as obsolete as a celluloid collar and a fancy vest.

Henry's exclusive process first removes every trace of moisture from a dryer; then it is pressure-sealed with dehydrated air. No matter how long a period may elapse until actual installation, this fact stands out: *The hissing sound you hear when you loosen the seal cap of a Henry Dryer is absolute proof of original factory dryness.* If a Henry Dryer does not hiss, your jobber will exchange it for a new one.

Protect your jobs against expensive service "call backs." Insist upon the new Henry Abso-Dry Dryer. It costs no more than ordinary dryers and guarantees *its* dryness with a hiss-s-s-s!

THE SONG OF THE DRYER

To the tune "Is It True What They Say About Dixie?"

Is it true what they say about Henry;
Is his charge ABSO-DRY all the time?
Is every trace of moisture removed
From Henry's core?
Does Pressure-Sealing fix him
So he will soak up more?

•

Is it true that he'll save you more money,
Every time he's installed in a line?
ABSO-lutely! Remember the last
Line of this song:
Henry's hiss proves you can't Go wrong!

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Most dehydrating agents used in refrigerating systems are continually being sub-divided into smaller or dust-like particles. This may happen through the taking up of moisture, or by abrasion, etc. These particles restrict the capacity of, and sometimes completely clog the disc screens and filters with which the old, or conventional, type dehydrator is equipped, resulting in pressure drop and eventual trouble at the expansion valves.

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MORE EFFICIENT · LESS RESTRICTION · GREATLY INCREASED SCREEN AREA ·

Bonney No. T35 Reversible Ratchet

A quality tool in every respect, this new reversible ratchet handle will meet your needs for refrigeration work.

Light in weight—strong, perfectly balanced, it has an enclosed ratchet, to keep out dust, dirt, grit and grease.

The 3/8" lug makes it adaptable for use with all 3/8" square drive sockets and attachments. On the other side of the head is a 1/4" square opening for use on small refrigerant cylinders, shut-off and reducing valves, compressors, motors, etc.

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